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BUILDING A MANAGEMENT PLAN

THE BASIC DATA

JOHN F. PRESTON AND I. F. ELDREDGE

This article is an attempt to further elaborate the discussion of this subject which appeared under the title, "High Spots of Modern Management Plans for the National Forests," in the JOURNAL for February, 1923. The subject has undergone such a fluctuating history, in which the pendulum has swung from one extreme to the other, that it is well worth while to take stock of what the present development indicates. The first attempts in preparing management plans for the National Forests presupposed the accumulation of a vast amount of detailed data which experience proved could not be used. The balance between the intensity of use and the intensity of basic data had not been struck, with the natural reaction that later efforts were made to prepare some plans of timber regulation upon very inadequate information. Some of these later efforts could hardly be dignified by the name of management plans, since the indications are that a little additional research will show that the foundation is too weak to support the structure. The extreme is indicated by a question asked at one of the Forest Service conferences as to whether or not it is feasible to gather together what facts are available, call in the stenographer and dictate the management plan, all in one sitting, as it were.

There is, of course, danger in both extremes. The cost as well as the mental effort incident to the collection of a great mass of information and the possibility of its inapplicability to the problem in hand, discourage the attempt to get it. If the job of preparing a management plan is too big for a busy forester to undertake, even with additional money and other help, very few plans will be made. On the other hand, if the essential facts upon which to base sound conclusions are lacking,

management plans will not insure the confidence which is so essential to their success. It is necessary, therefore, that we have a clear vision of exactly what kind of and how much data are essential in the preparation of a sound management plan.

The foundation needed for the preparation of management plans must, of course, vary with the circumstances surrounding each particular forest tract. The intensity of the plan and consequently the detailed facts and figures required will vary with the intensity of the use of the forest. The more complex the product to be sold, and the larger the number of users, the more complicated becomes the plan of management. The character of the plan required varies also with the character of the forest, the variety of species and forest types and with the topography as well as with the silvicultural system which is being practiced. The care with which the foundation can be laid is also, of course, directly dependent upon the amount of money available and usually the National Forests have none too much money to spare for this work.

PREPARATORY STEPS

The preliminary steps in the preparation of a management plan are:

(1) The assembling of all available data, including maps and timber estimates, in order to lay out roughly the boundaries of the working circle and determine what additional information is required:

(2) A tentative decision on all important policy points. This can usually be made before the management plan is prepared and materially assists in pointing out what data are needed. Perhaps the decision on policy matters may even postpone the preparation of the management plan where the policy is to withhold a part or the bulk of the timber from the market. Many of the points of policy may have been already settled or are covered by district or service wide policies and the local forester has only to adapt them to the needs of his particular situation.

(3) The next step, with the available data and the policy settled, is to work out the skeleton of a management plan with the object of showing clearly the ground to be covered, where more information is needed and exactly what kind. This step will avoid the later embarassment of finding out that much of the information collected at considerable cost is not needed in the preparation of the plan.

(4) A detailed plan for carrying out the field work is then made in consideration of the amount of money and the personnel available and the importance of the plan. It is sometimes worth while to go slow even if it is necessary to spread the work over a period of years. It is seldom that a given working circle is in such immediate need of a management plan that inadequate or half-baked information must be accepted as a foundation rather than to delay the writing of the plan a season or two until a better foundation is laid.

COLLECTION AND ANALYSIS OF DATA

Experience in the preparation of management plans in recent years show that the following problems are the ones most commonly encountered, to solve which systematic survey of the situation is essential:

Productive Land.—One of the first questions to be answered is the total area of productive land on the forest tract, excluding from consideration alpine or protection forests, barren land, agricultural and grazing lands, and inaccessible areas. It is not much of a job to determine roughly the total area of productive forest land for the particular forest tract for which a management plan is being prepared. Rough data are usually sufficient, because, in the first place, our definition of what is productive forest land is likely to change in the future and some of the areas now classed as alpine or protective forests may later be included as productive land, and, in the second place, a margin of as much as 10 or 15 per cent more or less in the total figure, translated and reduced into terms of the number of acres to be cut annually or over a period of years covered by the cutting budget, does not represent a serious error. The total cutting budget rarely covers a period as great as one-fifth of the rotation period and even a considerable error in this figure can be corrected in later revisions without serious injury.

Merchantable Timber.—The determination of the area of merchantable timber demands somewhat greater accuracy than the preceding factor, because we are getting closer to the point of action, but even here an error of 5 per cent more or less is not serious.

Where the estimate of the area of merchantable timber is within the standard of accuracy given above the determination of the volume of timber is ordinarily satisfactory for use in management plans if the estimate is within 25 per cent more or less of the correct figure. This

is true because the actual cut is or should be at least partially determined by area calculations and the cut so calculated for any given year or period is allocated to a specific area. This area is usually given an intensive survey, involving a very accurate estimate of the cut before it is sold, and an error within the allowable margin in the original estimate will not lead to over or under cutting. In the cases where volume alone is the basis of the calculation of cut, and these should be rare indeed, a greater degree of accuracy in the original estimate is obviously necessary.

Age Classes.—Since the regulation of the cut usually amounts to spreading the cut of the mature timber over the period required for the growing of the next younger age class to merchantable size, an obvious need is a determination of the area and distribution of age classes.

Where a partial cut under the selection method is indicated the forester must obtain a knowledge of the ratio of the various age classes in the stand either by area or by stems in the stand table for the average acre before he can fairly decide the period over which the cutting of the mature age class must be spread. Again, where the working circle is made up of stands of timber, each even-aged but each of a different age class, it is necessary to learn the proportion by area and the location of the different age classes in order to determine the sustained yield possibility by volume and area, to provide for the order of cutting and to allocate the cut for the first budget period.

Not very much refinement in field methods is necessary in collecting information about the distribution of age classes. Rough estimates are sufficient, because only a broad classification of age classes can be used in the preparation of most of the management plans of the present day, and further because a close distinction in age classes involves an intensive field examination whose cost would be disproportionate to its value. There may be some cases where refinements are justified, but they have not been so far encountered in the management plan work for the National Forests.

Sites.—Our knowledge of site is as yet somewhat hazy and inadequate, and the lack of refinement in other fields of knowledge is such that fine distinctions between sites is uncalled for. For a part of the management unit, however, the question of site classification is sometimes very important, since the productiveness of the area from which the next crop is to come is the important question to be decided. The

xt crop must be ready when the cutting of the present mature crop is mpleted. Therefore, for that portion of the forest upon which re- nce must be put for the next crop, a rough division into sites is ually required, especially where the site differences are marked. The rrect use of this factor on that part likely to be first in demand for e second harvest may make a material difference in the period of hold- g mature timber which ought to be cut for silvicultural reasons. Any ch classification should be kept as simple as possible, but should be rrect to within 10 per cent more or less. In many cases it will be fficient to take only such site observations as will lead to a conclusion to the average site class of the area upon which the second crop is ing grown. The study of growth should, of course, be made by the e classification determined upon, and the calculation of the period er which it is necessary to spread the cutting of mature timber ould fully consider the variation in the productive capacity of the fferent parts of the forest unit.

Forest Types.—The distinction between forest types is often of rime importance in drawing up prescriptions of management. Type assification is particularly important where some types contain species ry much in demand and other types contain species which are now nsidered as inferior and bring very low value or are marketable with fficulty. Except where accurate type boundaries are essential be- use of their bearing in the calculation of stand by volume or where an merchantable type is involved, no great degree of refinement is called r in classifying type distinctions and locating them on the map.

Rotation.—The question of rotation is largely one for the future. ur knowledge of the rates of growth to be expected of timber grown nder management is not good enough for more than approximate use the calculation of rotation. A hair line determination of rotation in e rough plans of today would be out of balance with other calcula- ons of equal or greater bearing. The limitation of cut is decided rtly and in many cases largely by factors which must have greater eight; such, for example, as the practical requirements of logging, the olume of mature timber, its apparent rate of decay, the danger of in- ct attack, the necessity for meeting the requirements of local wood- sing industries, etc. As the intensity in the use of the National Forests ncreases, greater refinements in all phases of management, including e determination of the rotation, will naturally result.

Of the different kinds of rotation usually recognized in the text books of forestry, only two are considered applicable to public Forests at the present stage of development—the economic and technical rotations. Rotations based on financial calculations are believed to be wholly unsuited to such use. Therefore, in collecting the material for a management plan, one is concerned usually with the growth period required to produce a satisfactory sawlog or a railroad tie, a telephone pole or a mine timber. In the great majority of cases that period of years which results in the maximum volume production is taken as the rotation. Some ring counts on stumps or from increment borings are needed to establish a conservative judgment, the extent of which will obviously vary with the complexity of type and site.

Growth.—Since the period of time over which the stand of mature timber must be spread is determined primarily by the length of time it will take the crop that is to follow in order of cutting to grow to merchantable size or to a certain size, it is of importance to gather all facts possible concerning rate of growth. In some cases, it is, of course, impossible to bridge the gap in age classes because of either the quantity or condition of the mature timber, but even in such cases, the determination of the time required for bringing the next younger age class to merchantable size is important in order to determine the extent of the hiatus. In even-age stands where clear cutting is to be practiced, yield table figures, if available, are usually sufficient, but to apply the yield tables with any degree of accuracy requires a division of the area of immature timber into rough site classes and the determination of the average density or degree of stocking for each site. In selection forests or those adapted to the partial cut method, the determination of the length of the first cutting cycle is involved. A stand table must be prepared showing what is left after the first cutting and the rate of growth of this remaining stand must be determined. This must, of course, be calculated for the various types involved, and, if radical differences in site exist, this must be taken into consideration. In the usual case, the determination is made for the most important type and for the predominant site and correction factors applied to other types and other sites.

It is difficult to say to what refinement it is necessary to go in the determination of growth. Most management plans are based on knowledge which is not as good as it ought to be. Experience indicates

that the savings should be made in the determination of other factors rather than this one.

Economic Conditions.—The economic situation, as it is now or as it may be logically expected to develop, is at this stage of our management plan work often of overbearing importance in setting the time, place, rate and method of cutting. The presentation of the problem in written and graphic form so that it will be readily grasped by one not thoroughly acquainted with local conditions is often no small job, but it rarely calls for field work. The question of the practicable size of output for a logging operation, the need of giving support by means of logging operations to local communities, the obligations already incurred to meet the needs of existing wood-using industries, and the whole relation of public and private lands, are some of the questions which must be faced and decided before much progress can be made with the management plan. Not only the conditions as they now exist must be shown, but the maker of a plan must at least indicate the tendencies of development of such important factors as transportation, manufacturing methods, change in market for some species or commodities, etc.

Tabulations and Maps.—An extensive survey or examination usually is sufficient as a basis upon which to compile the data described to the indicated degree of accuracy. A management survey can hardly be classed as an extensive reconnaissance in the sense in which that term has been used in the Forest Service. It is not simply a cruising or mapping expedition, but is rather a bolstering up of existing data for immediate use. The field work, of course, merely fills in where it is shown that the inventory is weak. Management surveys for the National Forests have cost from 3 to 6 cents per acre. The material collected in the field is put in the form of tabulations of area and volume and in the form of maps.

Area Figures.—The area figures resolve themselves into three classes:

(1) Area of productive land.

(2) Area of different types, with emphasis on those containing a high percentage of the present valuable species.

(3) Area of different age classes.

(4) The area of important sites on that part of the productive area to be called upon for the first harvest following the removal of the present mature crop. In the partial cutting system this would become

coincident with the area of present mature timber. In a clear cutting system it would be the next younger generation of trees so located as to be most likely to be in demand at the beginning of the second cut.

Volume Figures.—The volume or stand estimates would consist of:

(1) An estimate of the present merchantable timber to be cut.

(2) Figures showing the average density or degree of stocking by sites (if necessary) on the area from which the next crop will be harvested. For a partial cutting system this would involve a stand table showing what is left. The accuracy of the estimate of the stand which forms the basis of the second cut is far more important for management purposes than is the estimate of the present merchantable volume.

(3) Where figures of growth are sufficiently comprehensive they should be either tabulated or shown graphically.

Maps.—Maps are necessary both to give a comprehensive picture, as well as to furnish the source of the area figures already mentioned. Flat base maps showing drainage systems are entirely adequate for management plan purposes. Topographic maps are not at all essential and cannot be made at the above cost figures. The scale of the maps should never be less than one-half inch and seldom larger than one inch per mile. Experience shows that the following maps are necessary:

(1) A base map showing streams, ridges, survey lines, railroads, roads, towns, sawmills, etc.; the boundaries of management sub-divisions, such as working circle, blocks, compartments, and units (or sub-compartments), and the areas chosen for the cutting budget for the next 5, 10, or 20 years. If the privately owned lands are not too numerous and the problem too complicated, it is possible to show these areas also on this base map, otherwise a separate ownership map is needed.

(2) A separate map (more or less diagramatic) showing the barest skeleton of drainage, the management sub-divisions, the productive forest land, forest types, age classes, and whatever site distinctions are attempted. If the variation in forest types and age classes present too many complications to be presented clearly on one map, then it is necessary to show types and age classes on separate maps.

An adequate presentation of the data requires from two to four maps. In rare cases where only one forest type is involved and with an all-aged forest and little variation in site such as is sometimes presented by our western yellow pine forests, it is possible to present all of the data needed on one map.

Execution of the Plan.—The writers believe that with data as indicated in the foregoing paper, a perfectly safe and satisfactory plan of management can be prepared. It will be adequate to fix the time, the amount, the place and the method of cutting. It will not be sufficient for administration of the forest property, and for that portion upon which the business is centered, namely, the area included in the cutting budget, much more accurate knowledge is needed. Topographic maps, accurate cruises, careful surveys, and permanent monuments are needed to carry out the prescriptions of the plan, but it must be remembered that the cutting budget covers not more than 10 to 20 per cent of the area of a working circle and that outside this area the forester responsible for execution of the plan is not immediately concerned. His job is to handle the forest as provided in the cutting budget and to do it requires all the refinements of the forestry profession and all the skill of the forester. While the management plan may be made for from 4 to 6 cents per acre, the preparation of the budget area for sale may require an additional expenditure of from 10 to 20 cents per acre.

Future Regulation.—We are coming to realize more and more that the regulation of cutting on the National Forests will in its last analysis be determined by the "cut and try" system. We will make the best guess possible in the first draft of the management plan and then try it for 5, 10, or 20 years and keep a record of the result. This will furnish a sample plot on a definite percentage of the productive area which by comparison with the uncut timber and with further data on growth will give the best possible guide for fixing the limitation of cut for the future. A management plan is never finished. The surveys which we make now and the data which is collected will not be satisfactory to the future forester, or even, maybe, to the present forester in the future, but if we have turned over to our successors a forest in good silvicultural condition for the areas cut over, and a working circle which has not been ruined by over-cutting or gutted by mislocated cuttings, that should be enough to satisfy them and us. We cannot make a forest inventory now which will serve the purposes of the future forester, and this is one of the reasons why the pioneer management plans for the National Forests are being made after a comparatively rough examination of conditions in the field.

THE GROUP SELECTION METHOD WITH WHITE PINE

By A. C. Cline

The Harvard Forest, Petersham, Massachusetts.

The effect of the new Massachusetts forest tax law, and of the application of silviculture on the financial outcome of timberland ownership are particularly well illustrated by an operation carried out in 1923 by the New England Box Company in co-operation with the Harvard Forest on one of the company's tracts in northern Worcester County. The operation involved principally the group selection cutting of white pine growing on the better grade of light, sandy soil. The logging was done by the company and the Harvard Forest was responsible for the plan of management and the supervision of the operation.

Although insufficient time has elapsed to permit of a report on the reproduction obtained, the outcome in this particular case may be considered successful even though scanty reproduction should result, for the reason that over two-thirds of the area was stocked with young growth to begin with.

Portions of but two of the seven stands on the tract were operated in 1923, but in arriving at the method of handling these portions it was necessary to consider the status of the entire tract. Hence the following tabulations of areas, volumes, costs, etc., are presented.

Areas and Merchantable Volumes by Stands

Stand	Acres	Age class [1]	Volume per acre in bd. ft.	
			Softwood	Better hardwood [2]
White pine	65.0	II-III	5.4 M	.....
Pine, hemlock, and hardwood	20.5	II-III	5.8 M	1.0 M
White pine	9.5	II	10.0 M	.2 M
Pine, hemlock, and hardwood	10.0	II	4.5 M	.9 M
Hemlock and hardwood	2.5	III	10.0 M	5.0 M
Hemlock and hardwood	30.0	I-II	2.0 M	1.2 M
Pine and inferior hardwood	1.0	I	.....	.....
Nonforested land	11.5	.....	.....	.....
Total area	150.0			

[1] Age class I—0 to 20 years; age class II—21 to 40 years; age class III—41 to 60 years.

[2] Include paper, yellow, and black birch, beech, black cherry, and hard maple.

Note.—In the mixed stands listed above there is considerable material below the merchantable limit which may be considered present cordwood, or prospective saw timber.

Financial Status of Lot Just Before Operation

Initial cost of lot compounded to date ($4,000 at 4 per cent for 6 years)	$5,061.20	
Taxes compounded to date (Approximately $36.83 annually at 4 per cent for 6 years)	244.29	
Total cost	$5,305.49	
Estimated sale value	$7,000.00	
Assessed value	$2,000.00	
Assessed value per acre	$13.34	(Maximum allowed for registration under Massachusetts tax law, $25.)
Average volume per acre	15 to 20 cords	(Maximum allowed for registration, 20 cords.)
Prospective yield per acre	Sufficient	(Minimum required for registration, 20 M of softwood or 8 M of hardwood, or relative percentage of both.)

DESCRIPTION OF STANDS OPERATED

White pine, 65.0 acres.—This stand, with which this paper mainly has to deal, approached a two-story, group selection form, and consisted essentially of two age groups of pine, namely, 20 and 50, between which were scattered single pines from 1 to 30 years old. The groups were quite evenly distributed and of medium size (one-sixteenth to one-quarter acre). The average tree of the older group measured 11.0 inches in diameter, and 55.0 feet in total height; that of the younger group, 3.0 inches in diameter, and 25.0 feet in total height. The soil was a loamy sand, a Site II, not heavy enough to permit the presence of any hardwoods other than a few poplars and grey birches which offered no serious hindrance to the growth of the pine. A scattering of pitch pine and hemlock completed the composition of this stand. On a small portion of the area the ground cover was a mat of moss, lichen, and blueberry which precluded the initiation of reproduction unless torn up in logging. The growth of the pine understory was in many places seriously retarded by the overtopping older groups, to the extent that its economic age (about 20 years) was from 5 to 10 years less than its actual age. The younger groups, supplemented by many scattered individual (stem-wise) trees, were so distributed and in such amount as to promise, after the removal of the older groups, a stand sufficiently well stocked to permit of registration under the forest tax law.

Pine, hemlock and hardwoods, 20.5 acres.—This, together with the five remaining stands, was located on a westerly slope having the heavy soil characteristic of upland. It was an unevenaged, mixed stand containing sufficient merchantable pine and hemlock to justify cutting at once. In such event the young pines, hemlocks, and better hardwoods remaining after the cut would constitute nearly a one-half stocked stand. This cutting also could be made without jeopardizing the registration of the lot.

The remaining stands need not be described for purposes of this paper. With the exception of 9.5 acres of "old-field" pine, they were all unevenaged, mixed stands of pine, hemlock, and hardwoods on heavy soil—stands which were not yet ready to cut. All could be readily reproduced naturally by either clear or partial cuttings, though by a clear cutting, hardwoods would be favored to a greater extent than would be the case with the use of certain forms of partial cuttings.

POSSIBLE METHODS OF TREATMENT

Both for the financial and silvicultural reasons the 65.0 acre stand of pine presented the main problem. In handling this stand there were two alternatives, namely:

1. The present merchantable groups of pine might be cut at once, leaving the young group-wise and stem-wise pines to form the major part of the crop at the end of the next cutting cycle, thus retaining the unevenaged form, or,

2. The stand might be left untouched for a period sufficiently long (about 20 years) to allow the bulk of the trees to reach sawtimber size, and then a clear cutting, thus changing the form from unevenaged to evenaged.

The advantages of alternative 1 were that the capital invested in the lot might be reduced immediately about two-thirds; that since the volume per acre of the tract approached the maximum allowed for registration under the forest tax law, a reduction in volume with, at the same time, little decrease in prospective yield insured the acceptance of the lot by the assessors; the unevenaged form of stand afforded better soil protection which is much needed with light soils, and gave promise of more satisfactory natural reproduction, although the reproduction period would be comparatively long; the increment of the overtopped young growth could be expected to be greatly increased by cutting the older groups; the merchantable groups would be cut at

nearly financial maturity; and no slash burning would be necessary in order to secure a well stocked stand.

On the other hand the only possible advantages of alternative 2 were that logging costs per thousand might be less; the form of stand could be changed to an evenaged one which might conceivably be the more desirable form for a comercial forest; by delaying the operation about 20 years, it could be made to include the bulk of the stands on the lot, thus possibly reducing certain operating costs per thousand, and at the same time the stumpage value of the pine might be sufficiently higher than at present to justify the delay. Among the disadvantages of this alternative the outstanding one was that, since no present reduction in the volume of the tract was anticipated, the registration of the tract was not assured.

After a consideration of the advantages and disadvantages of both alternatives, the first was chosen.

OPERATING UNDER THE GROUP SELECTION METHOD

White pine, 65.0 acres.—On 52 acres of this area the merchantable white pine, pitch pine, and hemlock were marked for removal, the young group-wise and stem-wise trees being left. The material removed (about 6,000 board feet per acre) consisted very largely of groups of age class III white pine. Special care was taken in logging not to damage trees which were unmarked. Marked trees were felled so that their tops would lie along the edges of the openings rather than in the middles, in order to leave the openings free for reproduction. If it had appeared desirable to burn the slash the tops would have been dropped into the middles to facilitate burning and to safeguard the encircling young growth. But in this case nothing would have been gained by slash disposal. As regards fire hazard, sufficient inflamable material would have remained after slash burning to cause a fire fatal to much of the young growth. Furthermore, slash burning in such a stand would have been very costly. No seed trees, as such, were left to start reproduction before the trees now left in the understory could reach seed-bearing size. There was, perhaps, some question as to the wisdom of cutting all the large trees capable of producing an abundance of seed, but the leaving of a scattering of big trees would surely have done harm to the understory, not to mention the

unsightliness of these seeders, and the need of their volume to "fatten up" the cut.

After logging, an inspection of the cutting area showed that the logging had been painstakingly done, and that the area was at least two-thirds stocked with group-wise and stem-wise pines. Of the total area about 30 per cent is now occupied by 20-year-old groups; 35 per cent by stem-wise trees, 1 to 30 years old; and 35 per cent by openings made by the removal of the older groups plus those existing before the operation. Assuming a rotation of 60 years, the following distribution of growing stock may be expected to obtain 20 years hence. A number of 4.0 to 6.0 inch trees, so located and of such size as to have justified their retention, are now present in the remaining stand. In 20 years these may be cut together with some of the groups (the oldest) from those now listed as having an average economic age of 20, thus making a number of openings which may be made to equal about 30 per cent of the total area. At that time the bulk of the groups which now average 20 years of age will be age 40, and not ready to cut for 20 years more. Their area, plus that occupied by stem-wise trees of like age, may also be made to approximate 30 per cent of the total area. Furthermore, at that time the present openings may be partially stocked with age class I reproduction initiated for the most part by the present 4.0 to 6.0 inch trees mentioned above. The area so reproduced may also approximate 30 per cent of the total. The remaining 10 per cent may be considered nonproductive area. Thus, eventually, three age groups may be developed with a rotation of 60 years, and a cutting cycle of 20 years.

Pine, hemlock and hardwood, 20.5 acres.—The lower portion of this stand, which adjoined white pine, 65.0 acres, was also marked for partial cutting. Approximately 8,000 feet of pine and hemlock per acre were removed. The remaining young stand of pine, hemlock, and better hardwoods was of such distribution and amount as to constitute after cutting a one-half stocked stand of age classes I and II. It is expected that the stocking of this area will be gradually increased due to the nearness of seed trees in the uncut portion of the stand further up the slope. About 8 acres of this stand were operated, making a total cuting area of 60 acres.

Logging and Milling Costs Per Thousand Board Feet

(Total amount cut, 381,000 board feet of pine and hemlock.)

Felling, bucking, and skidding		$5.52
Sled haul of 4 miles, and loading logs on cars at railroad	$8.66	
Freight (17 miles by railroad)	4.13	
Unloading at destination	.68	
		13.47
Overhead		1.51
Sawing		4.80
Stumpage		9.65
Total		$34.95

An unusually heavy winter with much snow increased logging costs considerably, though it is true that a portion of the added cost of logging was due to the partial cutting method. This added cost, however, may rightfully be charged against the remaining stand, together with the prospective supplement thereto in the form of new reproduction.

New Financial Status After Operation

Total cost of lot before operation	$5,305.49
Income from cut (381,000 at $9.65)	3,676.65
Present capital investment	$1,628.84
Sale value of lot, about	$3,000.00
Assessed value (land alone; lot registered)	$5.00 per acre

EXPECTABLE RETURNS

Had alternative 2 been chosen the management would probably have called for the operation of the tract in 1940. Assuming that in 1940 the owner decides to sell the tract, both land and timber, and to liquidate the investment, it will be worth while to compare the expectable returns at this time, as influenced by the alternative chosen. It should be borne in mind that the results below are only relatively correct, since the methods of calculating the future yields of mixed, unevenaged stands have not been perfected.

Expectable Return from Alternative 1

Net income from cut in 1940 (clear cutting of all merchantable material on the tract except any material on the 60 acres operated in 1923) (630 M at $15 per M, minus yield tax of 6 per cent	$8,883.00	
Sale value of land and young growth remaining after cut	7,000.00	
		$15,883.00
Investment remaining after 1923 cut, $1,628.84, compounded to 1940 at 4 per cent	$3,172.82	
Taxes to 1940 compounded at 4 per cent (land registered; assessed value per acre, $5, rate 2 per cent	355.46	
		3,528.28
Net profit on lot		$12,354.72

Expectable Returns from Alternative 2

Net income from cut in 1940 (clear cutting of all merchantable material on the tract) (1,400 M at $15 per M)		$21,000.00	
Sale value of land and young growth remaining after cut		1,000.00	
			$22,000.00
Initial cost of lot compounded to 1940 at 4 per cent ($4,000 for 23 years)		$9,858.80	
Taxes to 1923 (as stated above)	$244.29		
Taxes from 1923 to 1940 compounded at 4 per cent (assumed assessed valuation $3,000; rate 2 per cent; tract not registered	1,421.85		
		1,666.14	
			11,524.94
Net profit on lot			$10,475.06

A comparison of the above expectable returns from the two alternatives leaves little doubt as to which is the more profitable. In the case of alternative 1 the owner quadruples his money, while in the case of alternative 2 he falls a trifle short of doubling it. In both cases the investment period is 23 years.

The group selection method as applied in this case, instead of a method commonly used by lumbermen (clear cutting), furnishes an example of the increased profitableness of forest production when scientific management is applied.

White pine in the unevenaged form is found growing as a relatively permanent type on light, sand and gravel soils of north central Massachusetts and southern New Hampshire. The permanent character of this type is due to the impossibility of hardwoods of vigorous growth coming in in sufficient numbers to crowd out the pine. On the better grade of light soils where the rate of growth of white pine is sufficient to justify its continuance for successive crops, the selection method, or one of its modifications, appears to offer the best adjustment of financial and silvicultural needs.

On the most sterile of the light soils the rate of growth of white pine is oftentimes so slow that it is probably advisable to recommend its replacement with either red or Scots pine. Plantations of red and Scots pine on sand plains in this vicinity exhibit a much better rate of growth than that of white pine on the same soil.

On the heavy upland soils white pine is commonly found in the evenaged form growing on abandoned farms. While no system of reproducing the "old-field" type has yet been devised which will effectually check the determined ingress of hardwoods both before and during the reproduction period, the clear cutting and shelterwood methods, following by weedings, have given the best results.

THE PRESENT STATUS OF STATE LANDS

By W. T. Cox,

Former State Forester of Minnesota

At the time Minnesota was admitted to the Union it was given sections 16 and 36 in each township except those included in Indian reservations. Later on a large quantity of so-called swamp lands was granted to the State by the Federal Government. In all several million acres were owned by the State.

Much of this was given away to encourage the construction of railroads and for other purposes. Some was sold, timber and all. Some was cut over and the land sold as agricultural land. Hundreds of thousands of acres have been cut over and remain unsold.

The State lands at present comprise about 1,775,000 acres, mostly in the northern tier of counties.

Approximately 600,000 acres of this still bear virgin timber, the remainder being either culled over, clean cut, burned over or naturally open bog country. Second growth timber in all stages is found. There has never been an inventory of this great property which, if the second growth is taken into account, must be worth forty million dollars. This constitutes the most valuable forest property owned by any State.

After much agitation an amendment to the State Constitution was adopted in 1914 authorizing the segregation of State lands for permanent State forests. And in 1915 the legislature set aside about 380,000 acres for this purpose. Itasca Park was also made a State forest; it comprises 32,000 acres so that at present there are a little more than 400,000 acres in permanent State forests. These lands are one-fourth virgin timber, one-half second growth, and one-fourth denuded. They are under the charge of the Forestry Board and on them forestry is being practiced. Where sales are made care is exercised in the cutting so as to keep the forest continually productive. The immature trees are left to grow and nature does the reforesting. Each year such small trees as are available in the State nurseries are set out on barren areas within these State forests. Fires have been permitted to do but slight damage on these lands.

Of the 1,375,000 acres of State lands outside the permanent forests about 500,000 acres bear timber. The rest is cut over, burned over, second growth or lightly timbered swamp.

This land is under the control of the State Auditor as Land Commissioner. It is his function to sell the land at not less than $5 per acre. He advertises and holds sales annually at the county seats of counties containing State lands.

In the Auditor's office there is also the Superintendent of State Timber whose duty it is to dispose of the timber on the unreserved State lands. He has appraisals made, fixing the minimum prices, and presents them to the Timber Board for approval, after which timber is advertised and sold to the highest bidder. A big annual sale is held at the Capitol and smaller sales in the various counties. The Timber Board consists of the Governor, the Auditor, the Treasurer, the Attorney General, and the Forester. Three of these constitute a quorum. There is no restriction on the amount of timber that may be sold in any one year.

During the years 1920-21 and '22 there was cut from State lands the following quantities of timber:

	Feet
Logs	100,851,000
Pulpwood	106,500,000
Ties	24,300,000
Posts	21,200,000
Poles	9,200,000

A total of 262,000,000 feet or an average of a little over 87,000,000 feet a year.

The figures for last year's cut will be a little less. However, the amount of timber sold last year was considerably more.

This shows that the sale and cut of State timber up to the present date are proceeding at an alarming rate. For years we have urged a reduction in the amount of timber sold. It is probable that there remains on the State lands only about 500,000,000 feet of mature timber, and anyone can see that if this is cut off at the rate of 60 to 100 million feet a year it will last but a few years. There are 453 timber permits now in operation on State lands; 161, part cut, 104 new sales this year, 181 last year, 168 permits which had expired but were extended. So it is seen that the business of cutting timber from State lands is no small matter. It is about as large in volume as it ever was in the history of the State.

The cutting of timber from State lands is proceeding at a rate several times greater than the rate at which cut-over lands are being sold for agriculture, so we have an increasing cut-over land problem.

As State Forester and a member of the Timber Board I have urged restricting the annual sales to not more than 25 million feet a year, which would make the mature timber last about 20 years, at which time the second growth timber will be an important factor, and the cut of which may then assume considerable proportions. It seems very difficult to bring about a lessening of the amount of timber sold annually, even though there are so many arguments for slowing down on sales. Not only is the State severely over-cutting its mature timber, but the method of cutting is exceedingly destructive, and uneconomical. The clean cutting of timber from State lands destroys productive forest property. It interferes with game, it renders the forest country less attractive to tourists, and probably affects the water condiions in several ways. It also increases the fire hazard, and may mean the replanting of the land at high cost, which might just as well have been avoided by a proper system of logging. It may be an astounding statement to make, but I am not at all sure but what the people of Minnesota are suffering as great a loss annually through wrong policy and methods in logging as they are from forest fires.

Last year the timber on 40,000 acres of State land was sold. If this were all cut clean in the usual way and the forests destroyed, it would mean an annual cost of planting that acreage at say $15 per acre, which would be $600,000. In addition it would mean the loss of the yields we should have had from cuttings made at twenty and forty years, equal in each case at least to the returns being realized from the sales being now made on these lands. In other words, the clean cutting on forty thousand acres means a loss to Minnesota of $1,000,000, as well as the shortening of the life of wood-working plants and the throwing out of employment of woodsmen and mill workers, and an increase in the cost of wood products through having to import them.

It is true that the Timber Board has gradually given to the Forest Service the privilege of reserving some timber in sales made on State lands. At the present time the Forest Service has a number of crews in the woods marking trees and blocks of young timber for reservation in sale areas. This is a decided step in the right direction, and will mean the saving of much thrifty timber for future growth. It will mean also the natural reforestation of large areas which otherwise would have to be planted artificially. However, it seems to me there is only one thing to do with State-owned timberlands. That is to include them within the permanent State forests. It is then worth while

to conduct real forestry operations. To attempt to practice forestry on lands not within the State forests is a gamble at best, for we have no assurance that the lands and timber on which the Forest Service conducts marking and other work, and expends large sums of money may not be sold a year or two hence, seed trees and all. One simply must have a guarantee of continuity in the management of such property before the work and expense necessary to inaugurate forestry practice is justified.

As an illustration of the uneconomical practice in the sale of State timber, let us take, for instance, a cedar tree 7 inches in diameter and 30 feet high. This tree is not large enough to make a telephone pole, but will make three 7-foot posts for which the State receives as stumpage one cent each, or three cents for the tree. Now if that tree were to be permitted to grow for another 10 or 20 years, it would then be large enough for a pole, the cheapest of which brings 20 cents, stumpage, and there would also be at least one post in the top; so the State would receive at least 21 cents. Figuring the maximum time it would require to transform the 7-inch tree into telephone pole size, that is, 20 years, the State would be making money at the rate of nearly 10 per cent compound interest by reserving such a tree from immediate sale. The same conclusions may be arrived at in the case of young spruce trees not yet large enough for more than one or two sticks of pulpwood. It would be exceedingly profitable for the State to retain such trees for further growth. Moreover, it is very doubtful if the timber operators cutting trees of these small sizes really make any money at all from the operation.

Take the case of pulpwood exported from Minnesota. This emphasizes the need for a better policy in timber sales and better methods in cutting operations. In the selling of State timber sometimes so much is offered at once, that it cannot well be bought by Minnesota concerns, especially if the sale is held at a time when the mills of this State are stocked with pulpwood. As a result, Wisconsin mills buy heavily of State-owned spruce.

It requires about 40,000 cords of pulpwood to run a fair-sized paper mill for one year. Forty thousand cords of spruce pulpwood at Two Harbors or Duluth ready for shipments to Wisconsin may be considered to be worth $10 a cord, or $400,000—the price varying of course from year to year. That would be all that the people of Minnesota would derive from the material if it actually goes to mills outside the

State. On the other hand, suppose that this 40,000 cords, instead of going to Wisconsin, is deflected to a Minnesota plant, say at Cloquet, Grand Rapids, or Little Falls. There would be paid out to Minnesota railroads $40,000 in freight, perhaps more. At the mill in order to convert the pulpwood into paper, there would be paid out in wages $600,000. The use of this spruce pulpwood makes possible the use of at least an equal quantity of so-called inferior woods that may be mixed with the spruce, thus doubling the quantity and really running the plant two years, instead of one. Consequently there would be paid out in wages $1,200,000 instead of $600,000. There would also be an extension of two years in the life of the plant, and the taxes paid on it at $30,000 a year, or $60,000. There would be taxes also on the property of the officers and employees. So it is safe to say that for every 40,000 cords of spruce pulpwood shipped out of Minnesota, the people of this State actually lose more than a million dollars. Last year approximately 400,000 cords were shipped to the Wisconsin mills from northern Minnesota.

The remedy, so far as State timber is concerned, would be to put the remaining State timber land into permanent State forests where they can be given management and then to sell a small quantity of timber annually, holding the sales at times when the Minnesota plants are strongly in the market for timber.

HOW ONE WOOD-USING INDUSTRY HAS MADE USE OF A FORESTER [1]

By Guy C. Hawkins

Forester, New England Box Company

Twenty-five years ago the New England States had given little thought to the conservation of one of their great natural resources, the forest. Even those most concerned, the wood using industries, could maintain themselves in luxury, purchasing lumber for $10 per thousand at factory doors or buying timber lots of farmers and woodland owners who had only a limited knowledge of the value being conveyed.

It was in this period that the New England Box Company was incorporated and began in a small way the manufacture of wooden boxes. Within a few years the company was enjoying the reputation of being the largest concern in the world manufacturing lock-cornered boxes exclusively. Standing timber purchased and held but a few years necessarily netted substantial profits through rising stumpage values. Prosperity could hardly be divorced from wood-using industries under such conditions and why worry about the future lumber supply? To apply an expression of the director of one of our prominent New England forest schools, the New England Box Company had about as much use for a forester, during this period, as an Eskimo would have for an ice manufacturing plant.

FORESTER HIRED

By 1913, however, the situation had changed and the following facts obtained: Lumber had doubled in value to $20 per thousand at the company's factories, prophecies that the local timber supply would be exhausted in 10 years were whispered, a few thousand young pine trees were set out on the company's land and a forester was, may I say, set adrift amid the company's personnel—set adrift because at that time the officers had little conception of a forester's function.

[1] Delivered before the annual meeting of the Society at Baltimore, December 27, 1923.

Here was a job indeed—forester for a concern which had never made use of a forester before, with no precedents to follow, a concern buying timber with only the roughest of ocular estimates and with thousands of acres of timber land scattered over three States—and not a map. Put these handicaps together with that powerful element which many young men have to contend with, the natural prejudices of older men with the old-school lumbering ideas, towards young men with "new-fangled notions," and you have a situation that I warn prospective foresters to avoid if they wish success unless they possess indomitable ambition, a big capacity for work, a healthy body, and a strong will to carry into effect the elemental principles of their profession.

HOLDINGS INCREASED

A decade has passed. In 1923 we find the company manufacturing lock-cornered boxes, small fancy boxes, shooks, pails, and buckets, and handling 40,000,000 board feet of lumber annually, with ten factories ready to give the best of service. Timberland holdings have been increased through 330 purchases ranging up to 1,000 acres each, totalling some 30,000 acres scattered in selected areas through Massachusetts, New Hampshire, and Vermont, besides several million board feet of stumpage on land not purchased. In the meantime lumber has advanced to $30 per thousand, and it should be noted that these increased lumber values have much to do with the development of forestry.

JOB NOW WELL DEFINED

And now the forestry department's job is clear cut and well defined, working a force of five men surveying, and a crew of five men operating and carrying on investigations under the forester's supervision. An inventory of the company's land and timber holdings is nearly completed. Each lot is surveyed with transit (stadia method), bounds renewed or established, lines blazed and a careful cruise of the lot made. The cruise establishes first, the area of the smaller compartments of different timber or growth found on the lot and is obtained by compass and pacing back and forth across the lot in lines 400 to 600 feet apart, the map being built in the woods. Next the timber on each compartment is estimated, observations are made as to age, quality,

etc., and the results entered upon standard forms in such a way as to facilitate their tabulation on the inventory sheets. This form constitutes a working plan giving at the left the area, timber estimate and description of each compartment, while at the right may be found recommendations for management.

Each mill or the mills in a locality determine the working circle, or as we call it, group, and the inventory is built up by bringing under each group the estimates and working plans of all lots in that group. The inventory headings divide the pine stands into classes according to the time that they will reach maturity, while other species comprising an insignificant amount of timber are entered in a column for each species. The headings are as follows: Area and amount of pine which may be cut before 1925; Area and amount of pine which may be cut between 1925-1930, 1930-1940, 1940-1950; Area and amount of chestnut, hemlock, hardwood, spruce, hard pine; Area, natural regeneration hardwood; N. R. pine; To plant; Cordwood; Slash or open; Plantation; Total area; Total amount board feet.

Once this information is tabulated it forms a basis for all operations to be carried on. All available mature timber may be located readily for any mill. Lots requiring improvement cuttings or weedings and land suitable for planting may be quickly selected. In this manner a working plan for the entire property will soon be prepared and its practical operation is assured. As new lots are acquired they are treated as set forth above, the information is added to the inventory and the working plan kept up to date.

During the years required for the preparation of the inventory, other activities have been going on, several hundred thousand white pines have been set out, many hundreds of acres of pine up to thirty years old have been weeded, weavil extermination has been practiced and thinning operations have been carried on.

FORESTRY IN NEW HAMPSHIRE

It must be borne in mind there is a difference in character between forests in our section and those in other parts of the country. This was emphasized by Prof. R. S. Hosmer, President of our Society, when in making his report before the U. S. Senate Committee on Reforestation at Albany, he made the following statement: "The time has already arrived in certain parts of the country, as for example,

in the white pine region of southern New Hampshire and in parts of the South, where the growing of a forest crop is a profitable venture." I suspect that Prof. Hosmer obtained the facts for this statement from Dr. Austin Cary, who has in his characteristically diligent fashion searched the country for examples of intensive forest management to set forth as ideals, in his "missionary work" among the southern foresters and lumbermen. That he found what he was looking for in southern New Hampshire may be of less credit to the company on whose holdings he discovered such work going on, than it is to the fact that in that particular section of the country there exists a forest condition which lends itself most advantageously to the practice of forestry. I regret that there is not time here to enumerate the influences and conditions essential to such practice, for they are the basic elements upon which any forest must depend to make the growing of a forest crop a "profitable venture."

For the purpose of this paper, however, it is necessary to point only to the existing structure or formation of the forest. In as much as the company depends almost entirely upon white pine of box board quality for its lumber supply, the fact that there is almost no virgin timber within the territory of its operations presents no difficulty.

THE THREE FORMATIONS

Most of its lumber is procured from three forest formations:

1. Timber land cut over from 50 to 100 years ago which came back to white pine or white pine in mixture with hardwoods.

2. Old pastures which have been allowed to grow up to brush, hardwood or pine as the case might be.

3. Abandoned farms, which only a few decades ago were clothed by portions of the famous primeval New England forest and which are now cast back again onto the providence of nature, and nature has proved a good forester in many instances, where corn and rye fields as well as good mowing land, deserted in Civil War times, are now covered with white pine stands cutting from 20,000 to 50,000 per acre.

In buying lots upon which are found stands of one or more of these three formations it often occurs that other formations are acquired which in the early stages of their development were predominately pine but later have been transformed into hardwood stands of inferior species because of more vigorous height growth of such hardwoods.

I have dwelt upon these formations in order that the cause and effect of our forest improvement work might be more readily understood.

PLANTATIONS

Plantations have been made on abandoned farms or cut-over lots.

WEEDING PAYS

Weeding, in which inferior hardwood trees, such as grey birch and soft maple, are cut out for the benefit of the remaining pines or valuable hardwoods, gives the most productive results, for the money expended, of any intensive forestry work that may be carried on at the present time. From $2 to $7 per acre have been invested over large areas of the company's land in this work, while in special cases up to $15 per acre have been spent to good advantage, in order that these areas might develop into predominately pine stands instead of almost worthless tracts of hardwood.

NEBOX THINNINGS

Thinning has been resorted to in pine forests from thirty to fifty years of age where removal of from one-quarter to one-half of the volume leaves the remaining growth in good thrifty condition. The primary object of all thinning is to aid nature in yielding from a certain piece of ground the most dollars and cents possible in a given time. The officials of the New England Box Company have never been invited by their forester to practice or study this or that European method of thinning. A firm stand has been taken, however, against the clear cutting of lots in which are found immature trees either in solid stands or in equal mixture with mature trees, as is the method altogether too often practiced by New England lumbermen. Such lots usually show an over-crowded condition, the density allowing only a very small annual increment growth and after the taxes and interest on the investment are paid the net return in money is negligible if indeed there is no loss. In other words investment in such property yields no dividends. That, however, is no reason why the great timber-producing "plant" found in the more perfect specimens comprising

perhaps one-half of the trees, should be destroyed by clear cutting. Thinning lots of this character at the right age, by removing malformed, badly suppressed and the largest of mature trees together with all dead merchantable timber, leaving the remaining trees with plenty of space for crown development is productive of very satisfactory results. An underlying motive for this mode of thinning is, early reduction of invested capital with decreased taxes and interest charges in consequence. I have failed to observe anywhere just this system of thinning practiced or advocated and for lack of a better name have called it the Nebox method. This may serve to distinguish it from the Borggreve process in which all dominant trees are removed at a late stage of the wood-lot's development or the methods advocated earlier by both French and German foresters and more often practiced today in which the suppressed trees are removed and the fullest development of the dominating trees is assured. Nebox thinning may well be called a combination of other methods applied as common sense dictates.

The first lot treated by this method was operated in 1917. The lot was to be clean cut. The Forester obtained consent to select and thin a few compartments with the result that today these areas are covered with vigorous growing pine with crowns developing and timber increment increasing every year. Capital invested was reduced about one-half, taxes and interest charges were greatly decreased and it is safe to say that in fifteen to twenty years the areas thinned will cut as much timber as they would had they been left untouched for the same period. This lot offers a direct contrast to the many thousand acres of cut-over non-productive land owned by the company.

Every lot offers a new problem due to the differences in soil, age and density of stand, location in regard to mill, etc., but generally speaking there are many forests which respond remarkably to this treatment with sound economic results.

STUDY OF INFLUENCE OF DENSITY

A study of the influence of density was started recently on three sample plots on a lot near one of the factories; soil, age, and general conditions, except for density, being as near alike as possible on each. Table 1 presents a splendid opportunity for discussion.

TABLE 1.—*Trees and Cords Removed from Pine Stand 45 Years Old. Final Cut to be Made in 15 to 20 Years. Nebox Thinnings—Baker Lot—Winchester, N. H.*

Plot No.	Trees cut									Trees not cut		Grand total	
	Living					Dead		Total		Total			
	Good trees	Broken top trees	Crotched trees	Total		Total		Trees	Cords	Trees	Cords	Trees	Cords
				trees	Cords	Trees	Cords						
1	77	10	14	101	8.09	24	1.18	125	9.27	186	21.92	311	31.19
2	120	8	13	141	9.21	41	1.20	182	10.41	303	25.37	485	35.78
3	78	16	2	96	4.78	128	2.82	224	7.58	464	23.03	688	30.61

Scale used common to New Hampshire.

1 cord = 100 cord feet—contains the ordinary 128 cord feet divided into 1/100th or 666 board feet.

It is significant that salvaged dead merchantable timber taken from each plot may be applied as a credit against the increased cost of thinning over the clear-cutting method. The word salvaged is permitted because had this dead timber been left in the woods until a clear cut would have been made ten years hence, it would have been decayed and lost. It is also quite evident that on a given soil condition there is a certain density necessary for the greatest production of timber in a short rotation.

High quality of lumber is not demanded by the box manufacturers. Quick turnover of capital invested is desirable in any business. Thinning of crowded pine stands at the age of from 35 to 45 years, by the Nebox method and clear cutting 15 to 20 years later will best meet these requirements.

You may have noticed that in treating this matter of thinning no mention has been made of the natural reproduction which follows such an operation in most instances. Nebox thinnings are not made for the purpose of producing reproduction as an area may be clear cut and planted for less than the increased cost of thinning, but the company is very glad to credit the young pine reproduction as a by-product of the operation.

TAX LAWS UNSATISFACTORY

Up to the present time no attempt has been made to regulate the cutting of mature timber of which the company has a large reserve, except that the working plan shows its location and recommends clear cutting in large or small areas depending not only upon the location and nature of the lot but also upon the amount of reserve timber protection required by the mills of the group in which it is found. Present tax laws prevent this class of timber from remaining on the stump for any length of time under efficient supervision. It is probably unnecessary to state before this Society that a tremendous impetus could be given to intensive forestry, as a "profitable venture," by effecting some radical changes in the present forest taxation laws.

SPECIAL BUREAU

Now that these simple but effective methods of forest management have been demonstrated as practical and productive of dividends to

the New England Box Company we are prompted to expect that the neighboring timber land owners will soon become interested and adopt the ideas applicable to their wood lots. This will be encouraged through a special bureau which will place the forester of the company at the service of pine timber land owners within the area of the company's operations. The bureau will continue experimental work, keeping records of the results, and will reach its greatest usefulness through cooperation with the agencies already at work in the interest of "modern lumbering" and with the Northeastern Forest Experiment Station at Amherst, Mass.

PROGRESS MADE

Progress has been made throughout New England during the last 25 years through enactment of State forestry laws and development of forestry policies which it is hoped will aid and support the national policy now being agitated throughout the country.

In line with this general development progress has been made by the New England Box Company in its forestry program, manifesting itself most noticeably in the splendid cooperation now accorded the forestry department by the directors of the company while the working out of the practical problems is greatly aided through the giving away of old prejudices to a spirit of good fellowship and mutual helpfulness. By simple but constructive activities the foundation has been laid upon which may be built a broad comprehensive policy of forest management for the future.

ICELAND FORESTRY

By P. A. Ingvason

Iceland, from its very name, does not suggest forests or forestry to an American; yet the natives of the island are taking a lively interest in preserving the remnants of woodlands and in afforestation.

Iceland is so remote from the usual routes of travel that it may be well to mention that it is located between 60° 23′ and 66° 32′ North latitude, corresponding to southern Greenland, or those low, ice-bound islands north of Hudson Bay. The climate, however, is relatively mild, as is northern maritime Europe, since the Gulf Stream laves the shores, causing a mean annual temperature in Iceland of from 36.5° F. to 37° F., and an open season from early May until the close of October. The maximum summer temperature reaches 78° F. and the minimum winter temperature drops to 13° F. above zero, within the inhabited areas; not as low as in many localities within the United States in winter. It has been observed that tree growth, at least in the case of birch, is possible where the mean temperature during July reaches 48° F.

The area of Iceland is approximately 40,000 square miles, or roughly commensurate with that of Kansas or Ohio. About one-tenth of the total area is susceptible to cultivation, but much of the tillable soil is somewhat acid, requiring liming. Where drainage is deficient, often the soil is cold and compact. In spite of these adverse conditions, the land is fairly fertile and possesses great moisture absorption power. The island, chiefly of volcanic and glacial origin, possesses a central plateau rising from 1,300 to 3,200 feet above the sea, with mountains towering to a height of from 5,500 to 6,900 feet, a few of which are active volcanoes. Precipitation is ample, averaging 36 inches, but varying between 25 and 40 inches. Numerous rivers supply an abundance of water for irrigation, which is practiced also for frost protection by flooding fields likely to be frosted, and for improving the physical properties of the soil, increasing the fertility.

The flora, as may be expected, is sub-arctic, especially that of the uplands. When one reflects that several sub-arctic tree species grow on the North American continent up to the Arctic Circle, and that the

climate in northern Europe is much more equable than that of northern America at high latitudes, it seems only reasonable that the same species, and possibly several other species, should succeed in Iceland. It seems also that the native tree species are woefully deficient in the number of species, considering the relatively favorable climatic conditions. As a matter of fact, only *Betula odorata,* a birch, and the very rare species *Sorbus aucuparia* or European mountain ash, gained the dimensions of tree size. Even these two species are rather scrubby and small, the maximum height in either species being only 33 feet. *Betula odorata* and a willow, *Salix phyllicfolia,* forming thickets usually from 3 to 10 feet high, occupy rich bottom-lands subject to overflow. In colonial days, these thickets extended over extensive valleys and lower plateaus long since cleared for agriculture.

Because of nothing better, the birch especially has been of considerable economic value for fuel, iron smelting, construction, and repairs. In the course of the ten and a half centuries since Iceland was settled by the Vikings of Scandinavia and Celtic yeomen, the native birch forests have been exploited without foresight or regard for ultimate consequences. Iceland, to supplement the native wood supply, has long been importing timber from Scandinavia, and, in a small way, receiving in the form of driftwood washed up on shore, gifts from Siberia, and even occasionally a contribution of tropical woods transported thither in the Gulf Stream.

Unregulated and excessive grazing of livestock, forest fires, and such natural catastrophes as eruptions, tempests, avalanches, land slides, and excessive snowfall, have also contributed to the process of deforestation. The results are disastrous, since we find extensive areas robbed of their purest charms and most valuable resources. At the present time the forested area occupies only 200 square miles, besides a vast area of browse and brush of great value as forage.

Almost contemporaneously with the rise of the conservation movement in the United States, Iceland adopted the policy of conserving the woodlands that yet remained, a pitiful remnant of the original stands. This movement became effective in the decade beginning in 1900. Under the present laws it is positively forbidden to cut down or destroy any kind of arborescent growth, whether on public or private land. The conservation act in Iceland provides for the fencing of forested state lands, and for the purchase of forested estates. An office of State Forester was established, and a trained man appointed to super-

vise forest protection, planting, and educational propaganda. Four salaried assistants, or wardens, have also been appointed.

Private voluntary work in forestry is taken up by "The Association of Young People," comprising many local organizations, several of which now own small plantations. This association has established and observes an "Arbor Day." The "Culture Association of the Northland," organized in 1903, has also done very creditable work in encouraging forest planting, by maintaining a forest nursery which annually distributes tree seedlings through the rural communities and towns at low cost. Undoubtedly the various organizations actively interested in Icelandic forestry will eventually organize for more effective work along lines similar to those of the American Forestry Association.

Forestry in Iceland will take shape largely along lines which may be called "farm forestry." The trees will be grown mostly in farm woodlots, shelter belts, and to beautify the farm homes. Forestry practice is still in the experimental stage; local experience is gradually discovering and developing methods best suited to the peculiar natural conditions, which admittedly are difficult. Small areas have been planted and the outlook for regenerating the native birch woodlands is promising. In these stands the selection system is applied at present, although clean cutting in groups or strips should succeed, judging from the silvicultural characteristics of the birch; while propagation from cuttings will be used as far as the species adapted to our climate will admit. The coppice, or sprout system of regeneration will be employed with species capable of this practice, in order to reduce initial expense. The planting of seedlings and transplants from the forest nurseries will be, however, the chief method in afforestation. The nursery stock must be of the highest quality, as is everywhere necessary when conditions to be met are rigorous. Suitable nursery sites, protected and fertile, abound. Possibly sites watered by hot springs will prove most advantageous, just as truck gardens watered by thermal springs produce abundantly.

As the native arborescent flora is so meagre, and limited in economic value, the people are greatly interested in introducing foreign trees which may prove useful and hardy. The writer has been investigating promising American tree species, and sending back to Iceland seeds of various trees with the hope that at least some exotics may be found adapted to the severe climate. The willow-cottonwood family (*Salicaceae*) should furnish to Iceland some species of value. The

aspen (*Populus tremuloides*) is worth a trial, as it grows within the Arctic Circle on the North American continent, and traces of the European aspen have been discovered on the Island. White willow (*Salix alba*), an European willow widely propagated in America, is an interesting possibility. Other willows and cottonwoods may be found useful, especially Siberian species.

In the birch family, the European alder (*Alnus glutinosa*) seems to succeed fairly well. This tree may prove useful in afforesting the moors. During the first four years, this species has made a growth in Iceland amounting to 18 inches. The paper birch (*Betula papyrifera*) of North America may prove useful. Since the English elm has proven, in one instance, successful, it is possible that other species of this genus may be found sufficiently hardy, and that the American elm, so vigorous and widespread in its native home, may prove to be a contented resident in a far northern foreign home.

Of the rose family (*Rosaceae*), the mountain ash (*Sorbus aucuparia*), a native of the country and of continental Europe is the most promising, although the American species (*Sorbus americana*) should make a pleasing alternate of equal hardiness. On one plantation in Iceland, 9-year-old mountain ash trees measure 11.4 feet in height. Species of the genus Crataegus have already proven successful, *Crataegus sanguinea* doing well when grown from the seed, although imported seedlings have usually been winter-killed. The wild plums (*Prunus americana* and *Prunus nigra*) offer interesting possibilities, and will soon be given a trial. *Pyrus prunifolia,* a Siberian crabapple, is being grown in a certain Iceland nursery, where it has grown approximately 4 feet in 10 years. There are possibilities that this species may serve as grafting stock for some of the hardiest species of apple.

Russian wild olive should be tried because of its great resistance to unfavorable environment. Possibly an ash or two may be found, for the green ash thrives in the Saskatchewan Valley; while the black ash, which finds its habitat in the cold wet soils of eastern Canada, may be found of use in Iceland.

It is among the cone-bearing trees, the evergreens, however, that we hope for a larger measure of success in the introduction of exotics. The jack pine (*Pinus divaricata*) grows on the American continent well up to the Arctic Circle. Why should it not succeed as far north in the milder climate of Iceland? Even the scotch pine (*Pinus sylvestris*) has been grown with fair success in Icelandic forest nurseries,

where it has made nearly 18 inches of growth in 5 years. *Pinus montana* has proven hardy and should make an interesting decorative shrub. The red pine (*Pinus resinosa*) of Canada may even possess possibilities in Iceland. The Siberian larch (*Larix siberica*) so far, has thrived better in Iceland than any other coniferous species; 6-year-old specimens made a growth of 4.25 feet, and but few seedlings winter-killed. This suggests the introduction of the American species, *Larix americana,* a swamp-tree of Labrador and Alaska, enduring cold, acid soils, with a transcontinental range extending to near the shores of the Arctic Sea. The black spruce (*Picea mariana*), from the "spruce swamps" of Canada, and the white spruce (*Picea canadensis*), would both seem to possess characteristics to render them of use in Iceland. It is possible, also, that the Engelmann spruce and the Colorado blue spruce may some day find a place in this Island, as they are sub-alpine. The balsam fir (*Abies balsamea*) possesses with the above-mentioned spruces possibilities which have already been demonstrated in this distant northland.

In short, there are many species of trees growing in northern America and Siberia which should find themselves at home when once introduced in Iceland. Within a short time they will be given the opportunity to show their worth in a region far from their natural range. Along with the new American species we hope to introduce a measure of the indomitable spirit of the enterprise and achievement which characterizes the advance of Forestry in America. With the interest newly awakened, it is confidently expected that hundreds, or even thousands of groves of trees and shelterbelts will, in the course of some years, add interest to the landscape, affect favorably the economic problems of this northern land, and enrich the lives of its people.

THE APPRAISAL OF FOREST FIRE DAMAGES

By Howard R. Flint

U. S. Forest Service, Missoula, Mont.

In the appraisal of fire damages, the first point that should be considered is the use that is to be made of the values arrived at by the appraisal. It will do little good to know the amount of the loss unless some practical use is made of the knowledge. Three very practical uses for such knowledge appear immediately.

First. Any plan of forest regulation is as much concerned with timber burned as with timber removed by any other means.

Second. Without knowledge of the value of losses, no rational decision can be reached as to the sum which should be expended for protection. Cost of protection must be weighed against losses.

Third. Damages must be accurately ascertained if claim is to be made for reimbursement in fire trespass cases.

Since the practical value of reliable damage figures may well be accepted as admitted matter, it becomes desirable to define damage. Briefly worded, an excellent definition of damage by fire is embraced in the statement that it is the value of the property before the fire less its value after the fire. Really nothing else is involved and the problem of appraisal would be a fairly simple one if confined to accessible mature timber in a region of well established market values. Unfortunately, this simple condition is the exception rather than the rule.

Let us consider first the most popularly recognized and accepted form of damage; the damage to merchantable timber. The appraiser is confronted at once by the fact that in the United States the present value of the timber is determined almost wholly by its accessibility. When fairly appraised for lumbering purposes, remote tracts show a negative value, and by virtue of this fact might be regarded as fireproof because the value of the stand after the fire is not less than its value before the fire. However, it is probable that no forester and few timber owners would be willing to concede that the factor of inaccessibility alone will render a body of timber entirely worthless under present day conditions. Means of transportation will be devised and developed when the demand for timber increases the price to a point where remote holdings can be operated at a profit.

On the premise that all timber of merchantable species will probably be of value in the not very distant future, the appraiser is immediately confronted with future value, an indeterminable factor which vitiates any appraisal of remote timber and reduces the most carefully compiled figures to the status of a guess or an arbitrary establishing of values. There seems to be little to be gained in this problem from a study of past consumption and past stumpage rates in the United States, because the conditions which produced them are gone never again to return. A curve based on the trend of past and present values can scarcely be expected to furnish definite information as to what will happen in the future; therefore, it is scarcely practical to determine the probable future value of remote tracts and discount that value to the present as a basis for appraisal.

Stumpage appraisal methods may be accepted as satisfactory for trespass settlements on accessible tracts, but because of their susceptibility to a myriad of transient factors affecting market values, and because of the instability of stumpage appraisal values, they are not well adapted to statistical purposes. An illustration of one of the weaknesses of stumpage appraisal methods for statistical purposes may be found in the case of an appraisal made early in 1920 and based on average lumber prices for the preceding three years, all years of relatively high prices and wide margin of profit. The same tract of timber appraised on the basis of more normal lumber prices would probably show a considerably less value.

If the problem of appraising damage to merchantable timber is beset with difficulties, that of appraising reproduction is a veritable nightmare because all accepted methods are an attempt to apply scientific methods to data which are chiefly a matter of conjecture. The application of scientific methods necessarily presupposes reliable data kept over long periods of time. Such data on American silviculture will not be available for many years.

Theoretically, the calculation of damage to an immature forest may be based on either of two principles, and in fact all accepted methods represent some modification of one or the other of these methods. The fundamental methods are briefly described as:

1. Method by expectation values.
2. Method by replacement value.

The method by expectation values is complicated only in application. It involves only the simple business principle of discounting future sale

value of the crop of timber to the date of the fire in order to determine the difference in value before and after the fire. It is the only truly scientific method known to foresters the world over, and although often assailed, has never been overthrown as a method. It is the principle to which we must adhere if our appraisals are to have the stamp of scientific approval.

The difficulties in the way of the application of the expectation value method, however, are at present insurmountable because the use of this method presupposes the accurate determination of the value of the following factors:

1. Unit value of the crop at maturity.
2. Volume of the crop at maturity.
3. Length of rotation.
4. An equitable interest rate.
5. Cost of establishing the stand.
6. Cost of protecting the crop.

Recognizing as we must that reliable values for not more than one or two of these six factors, if indeed for any of them, are available at this time, we may as well dismiss the use of the expectation value method from present procedure. Refinements of policy can but lead to confusion, unless we are first fortified by corresponding refinements in fundamental data. Why finish and tie in the traverse with a solar transit after running the major portion of it with a pocket compass? The expectation value method should not, however, be lost sight of even for the present, as will be pointed out later.

It has frequently been argued that in the case of a forest on a sustained yield basis, no need for so complicated a method as the expectation value method exists, and in lieu of it, the replacement value method has been formulated. It is based on the theory that timber will be worth what it costs to grow it. This theory is not economically sound, although it is a catchy sounding phrase. On this basis, we might be warranted in placing exposed sites under glass, and in pumping water to dry sites, to increase the production of wood. The fallacy lies in overlooking the principle that the service rendered must be commensurate with its cost if the demand for the service is to continue. Extravagant methods cannot survive because a limited amount of timber can always be produced without them.

The replacement value method proposes to reimburse the cost of planting, if any, and the cost of protection, both with interest up to

the date of the fire, together with interest on the soil value. The sum of these items is taken as the measure of damages. The method has been used in European practice by timber insurance companies. Several modifications of it have been proposed from time to time in the United States, it is now used by the Forest Service, and in at least one case it has been accepted by a Federal jury in Montana as a measure of damages in a lawsuit.[1] It is a noteworthy fact, however, that in this case the Federal judge in whose court the case was tried ridiculed the principle on which the claim was based, but probably because of the technical nature of the problem, the point was passed over by the attorneys for the defense and the camel was swallowed by the jury with no evidence of strain or discomfort. Possibly the fact that the amount involved was more comparable in size to a gnat than to a camel had considerable influence in the accomplishment of the feat.

The replacement method and likewise its various modifications, is unscientific in that it is not based on results, either theoretical or actual. In refined calculations of damages, disorganization of management due to loss of sustained yield would be a distinct factor. It fails to distinguish between good and bad forest regulation, between sustained yield and timber mining. It fails utterly to place a consistent valuation on natural reproduction, as compared to planting after a fire. Surely a satisfactory natural stand is really worth as much from the standpoint of wood production as though it had cost the owner $10 per acre to plant it. The method is further open to the objection that soil rental cannot be accurately determined until the end of the rotation, and that interest rates are a matter of conjecture, and conjectures have no place in scientific work. Since this method is not scientific and since it fails to give values that are consistent or comparable, why seriously consider its adoption? It is a rudimentary method and a makeshift.

For forests on a sustained yield basis, the proposal has been offered that damage may be based on loss of annual revenue, resulting from several years' failure of sustained yield. Virtually this method says that loss or damage equals age times (average yearly growth in value).

This is unsound in theory and in mathematics, because it fails to discount the loss of annual growth to present worth. It also overlooks the fact that average annual growth does not truly represent growth for

[1] United States vs. Great Northern Railway Co. at Great Falls, Montana, September, 1920.

any period, and therefore does not represent the loss due to the destruction of an area of any given age class.

It is of course recognized that other resources than merchantable timber and reproduction are subject to damage by fire. Prominent among these are:

1. Protection forests, mature and immature.
2. Grazing resources.
3. Soil.
4. Recreation and scenic values.

In most appraisals in this country, no effort has been made to place a value on any of these elements of damage, except grazing resources, because, while the others are generally recognized by foresters, it is next to impossible, on the basis of present knowledge, to reduce them to terms of dollars, and also because the actual destructible values do not represent a large sum as compared to the value of timber and reproduction of merchantable species. Here, again, the things which are lacking are basic data, and until we at least start to secure them, there is but little use of considering in great detail the methods of applying them. The first essential step toward determining these values is to secure records of quantities and classes of resources destroyed.

So far this discussion of the subject has contributed nothing new to it, and has offered only destructive criticism of present procedure; nevertheless, there is no desire to urge that the effort to make appraisals on a scientific basis be abandoned. If forestry is to be worthy of a place among the professions, we, as foresters, are in duty bound to work without faltering on the problem until it is solved. I can offer no constructive suggestion other than that we recognize and accept the obligation to give our best efforts to the problem, and proceed toward its solution in a logical manner.

Recognizing that we are unable to apply accepted scientific methods to our fire damage appraisals because of the utter absence of reliable data, should we not start at once to lay the foundation for the ultimate solution of the problem of keeping records on which to base calculations in the future?

Exclude the determination of fire trespass damages from the problem and every other need for damage figures can very well be met by a rather accurate determination of the quantity and class of material destroyed, and the application to those quantities of fairly uniform arbitrary values fixed with reasonable regard for consistency and uniform-

ity. Of course, reasonable arbitrary values should be used, because the showing of excessive losses might easily lead to over-protection or to unfairly discrediting the effectiveness of the protective organization. On the other hand, greatly minimizing losses would tend to belittle the necessity for protection.

It is not strictly essential that there be a close relation between damage figures for statistical purposes and those used in recovering damage for fire trespass. Each trespass case must be worked up as a separate problem, the work must be done by specialists who can qualify as expert witnesses, and legal practices, the circumstances of the defendant, and the peculiarities of juries must all be considered. There seems to be no valid argument against using one set of figures for trespass cases and a different set for statistical purposes.

The appraisal of fire damages cannot always be made by highly skilled men, but must be made by many different men of widely varying degrees of ability and of differing points of view. Therefore, it seems desirable that the personal judgment of the appraiser should so far as possible be eliminated from the problem. Also because all appraisals cannot be made by highly skilled specialists, the method used should preferably be a simple one.

If we are ready to concede that present needs can be served by the collection of reliable data on quantity and classes of material, and that these data will be useful in future computations by more scientific methods, the great problem in connection with damage appraisals, and the problem which confronts every forester, whether in Federal, State, or private employ, is the collection and permanent recording of reliable and consistent figures on the quantity and kind of material lost.

It is extremely important from the standpoint of a national forestry program that the figures kept by the various agencies be standardized and comparable. Probably this end can be accomplished through the Federal control afforded by the Weeks law co-operation.

For merchantable timber, this means that we must secure and make an adequate permanent record of

1. Area burned over.
2. Type of species destroyed.
3. Volume of each species.
4. Per cent of volume which will be salvaged.

The figures on timber now required by Forest Service reports are inadequate in that they often fail to make a segregation by species in

any permanent and readily accessible record. It is also true that too little emphasis has been placed on the accuracy and reliability of the data recorded. In many cases, the figures have represented nothing more than a careful guess. In state and private practice, the figures secured on merchantable timber are certainly no more complete and dependable than those of the Forest Service, while those secured for reproduction are usually wholly inadequate and unreliable.

In the case of fire damage to reproduction, it is essential that a record be secured covering:

1. Area burned over.
2. Type and per cents of the most important species destroyed.
3. Number of trees per acre expressed in three broad groups, less than 100, 100 to 500, more than 500.
4. Age by 20-year classes up to 60 years.

For determining damage by fire to resources other than timber or reproduction, a record of acres and broad age classes of protection forest and acres and depth of duff or soil humus destroyed will probably meet the future needs for the determination of the value of those items. Depth of humus destroyed might be recorded in three broad classes; light, one inch or less in depth; medium, one inch to three inches in depth; heavy, over three inches in depth. Recreation and scenic values can probably best be considered on the basis of area burned over. Grazing values destroyed by fire are perhaps more tangible than most other forest values, and a record of current sale value of forage destroyed, such as is kept by the Forest Service at the present time, is probably all that is necessary.

Given these data kept summarized in permanent accessible form, it will be possible at any future time to determine with reasonable accuracy fire damages on the basis of values and practices then current, whether those methods be scientific or hit and miss ones. So far as I am able to determine, no agency is keeping a permanent and readily accessible record of all of the above data at this time, although some of them do essay to determine fire damage to reproduction by the expectation value method. The intention is good, but the effort is largely wasted. After all, what good are concrete values unless they are accurate and comparable? Quantities expressed in standard units of volume are directly comparable. If these are affected by values that are either correct or incorrect, but made uniform by agreement, they are still comparable. If we cannot have correct values, let us by all

means keep permanent records of reliably determined quantities and classes.

The arbitrary values to be used should be suggested by Forest Supervisors, State Foresters and large timber owners for their respective holdings, subject to harmonization and approval by the Forester. After being established, they should remain unchanged for a least a decade.

Since it is the purpose of this paper only to call attention to the inconsistency of forest fire damage statistics as now recorded, to point out the need for better statistics, and to outline the preliminary skirmish in a general attack on the problem, no attempt will here be made to go into the details of execution of the plan. If it seems apparent that there is sufficient general interest in the problem to warrant it, the values, forms and instructions developed and now in use in District 1 of the Forest Service will be presented in a future paper.

THE WORK OF THE FORESTERS OF THE PENNSYLVANIA RAILROAD SYSTEM[1]

By John Foley
Forester, Pennsylvania Railroad System

INTRODUCTORY

What follows does not imply that every railroad should have a forester as an official in its organization. While most of them have use for the information possessed by a forester of appropriate training and experience, similar to their need for the expert knowledge of chemists, metallurgists, and other specialists in materials, many railroads are not large enough or are not so organized as to fit a forester as such into their personnel. Some of them have the work which a forester could do handled by individuals with various titles, such as: Superintendent of Forestry or Woodlands; Land or Real Estate Agent; Manager of Timberlands; Manager, Superintendent, or Supervisor of Treating or Wood Preserving Plants; Superintendent or Supervisor of Timber or Wood Preservation; Consulting Timber Engineer; Lumber, Tie, or Timber Agent; Claims Agent. Some of those having the titles given above are men with professional education in forestry. However, the Pennsylvania Railroad System is the only transportation organization having a forester whose duties cover wood and woodlands as such from seed through service.

HISTORICAL

As might be expected from what is generally known as the "Standard Railroad of the World," lines now in the Pennsylvania Railroad System long ago took an interest in forestry. When the way to conserve forests prescribed about 100 years ago was to curtail the use of wood and to prolong the life of the wood used, the Pennsylvania put up brick and stone buildings and bridges, and as early as 1838 used bichloride of mercury in the first cross-ties treated in the United States They

[1] Delivered before the annual meeting of the Society at Baltimore, December 27, 1923.

were chestnut grown and installed north of here in Maryland. In 1840 a bath of lime was given pine stringers for a bridge in eastern Pennsylvania. In 1863 a plant to preserve with zinc chloride timbers for the bridge over the Susquehanna River at Havre de Grace was working at Perryville, Maryland. With the development of the steel industry wood went out of style in bridges. Substitutes for wood in ties were also tried, and experiments with them continue.

When the renewal of the forest by planting instead of its husbanding through lessening the use of wood became the prescription of the propagandists for forest perpetuation, the Pennsylvania Railroad undertook to provide some of its ties from planted trees, and set out 125,000 catalpas in 1887 and between 1902 and 1913, inclusive, 5,424,482 trees of 27 species, in 37 plantations, in 4 States.

Because the locust trees, which were used exclusively during 1902-1905, did not develop as expected (on account of insects), the Pennsylvania Railroad in 1906 requested the United States Forest Service to make an examination and report. This work covered the plantations then existing, other areas available for planting, and some of the woodlands owned by the railroad. The report recommended the employment of a forester, and this action was taken in 1907. Now ten foresters are employed.

The work of these foresters is briefly summarized below, under the headings and in the order of the classification of forestry published in the JOURNAL OF FORESTRY for April, 1917.

GENERAL FORESTRY

The varied work and widespread field of the foresters of the Pennsylvania Railroad System, which can be only sketchily referred to within the ten minutes allotted to this subject, require of them familiarity with forestry activities and literature in general. Answers to questions of every sort are in demand all the time.

FOREST BOTANY

Pennsylvania Railroad lines run through portions of New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Ohio, Indiana, Illinois, and Michigan, and thus put its foresters in touch with many species of trees, kinds of wood, and conditions of forest. Knowledge of the characteristics of the various species in cer-

tain localities is essential to decisions regarding their use in certain situations. Trees which do not grow along Pennsylvania Railroad lines are used by it—like cypress, Douglas fir, mahogany, redwood, and southern yellow pine. First-hand information regarding the behavior of all these woods on both sides of the sawmill is expected from the foresters of the railroad.

SILVICULTURE

The Pennsylvania Railroad gets water for its locomotives and shops in the mountain territory it traverses from reservoirs located near headwaters of streams where pollution is unlikely. These reservoirs are surrounded by wooded areas of 200 to 2,500 acres which are kept under forest cover. The foresters manage these woodlands as protection forests to prevent erosion on the watersheds they occupy and to yield wood products.

These watershed woodlots which constitute the bulk of the areas which the Pennsylvania Railroad has a direct interest in maintaining under forest cover were culled 20 to 50 years ago and are in need of various cuttings. The training and experience of its foresters is required to insure the handling of these properties in a manner which will enable them to function properly as conservers of water flow and producers of revenue.

Nearly all cutting is done under a marking system; sometimes each tree to be cut is marked; sometimes only the trees to remain above a cutting diameter limit. Brush is generally disposed of by lopping or scattering; piling and burning not fitting the hardwood stands involved, and requiring more supervision than is available.

Railroads do not always find it desirable or possible to acquire only the comparatively narrow strip of land required for tracks and stations. Parcels of adjacent property are perforce purchased for various reasons. It is on such land otherwise waste that the Pennsylvania Railroad tree planting was done. Since 1907 the foresters of the company examined the sites, decided the species and spacing suitable, and supervised the setting out of the trees.

A nursery of 50 acres which started on forest-planting stock exclusively is still operated by the foresters of the Pennsylvania Railroad, though its output has been wholly ornamental trees and shrubs since forest planting on a large scale has not been undertaken. These trees

and shrubs are mostly used in landscaping station grounds, plans for which are made by a forester.

FOREST PROTECTION

To prevent the emission of sparks from smoke stacks and cinders from ash pans, steam railroad locomotives are equipped with devices designed to make their operation as non-hazardous as possible. Not only are Pennsylvania Railroad engines maintained in effective condition to reduce the starting of fire to a minimum, but its right-of-way is maintained in a clean condition to retard the spread of fires which may occur. In this way and also directly the railroad cooperates with State forestry officials in forest fire prevention and extinguishment, contact for this cooperation being maintained by its foresters, who are responsible for instructions like the following, printed on 14½ by 22¼ inch placards, posted where employes are sure to see them:

PENNSYLVANIA RAILROAD SYSTEM

The Prevention and Extinguishment of Forest and Grass Fires

Stringent measures for the prevention and suppression of forest and grass fires must be taken to restrict the losses which they cause. The greatest danger exists before vegetation starts growth in the spring, after it becomes dormant in the fall, and during periods of drought at any time. Therefore, beginning about March 1st and October 1st, of each year, special vigilance must be exercised until the season of fire danger is past; and Supervisors, Track Foremen, and others will be governed by the following regulations:

SUPERVISORS shall have all vegetative debris on the right-of-way removed each fall as soon as the material is dry enough and weather conditions are favorable. Wherever desirable, and the consent of the owner of adjacent property can be obtained, the removal of hazardous vegetation should be extended far enough to eliminate all risk of fire. When fire is used, the burning shall be done with extreme care, and only if the weather is calm, or if the wind is blowing from the area to be burned toward the track. Sufficient men must be kept on the work to prevent the fire from spreading beyond control.

SUPERVISORS shall notify the nearest State Forest Fire Warden when large fires occur on land not owned by the Company.

TRACKMEN shall burn old ties and other debris at such times and in such places as will not result in any uncontrolled spread of the fire.

TRACKMEN shall promptly extinguish all fires which start on or near the right-of-way, and render all possible assistance in fighting fires whether on or off Company property.

ENGINEMEN shall use every precaution to prevent burning waste, hot conders, or any other inflammable material being thrown or dropped from engines;

shall clean ash pans and front ends only at points specially designated; and shall report promptly any defects in the devices designed to prevent the throwing of sparks or dropping of hot coals from locomotives.

TRAINMEN shall place fuses only where there is no likelihood of fire spreading from them.

TRAINMEN, and other employes, shall notify the nearest section-gang, and report to the Superintendent from the nearest telephone or telegraph, the existence of fires which evidently have had no steps taken toward their extinguishment. Freight trainmen shall, whenever practicable, stop and extinguish small fires, since waiting to report them might give them time to get beyond control.

OPERATORS shall transmit without charge, as Company business over Company lines, all messages relating to forest fires which are on or near Company property, or are likely to affect Company property.

GENERAL INSTRUCTIONS

The most effective way of curtailing losses from forest fires is to reduce their number and size. Use great care in the use of fire in the forest or the field. Do not throw burning matches or tobacco where they can set fire, and impress others with the necessity for following these precautions.

If a fire starts, take prompt and energetic action to prevent it from getting beyond control, and make use of telephone, telegraph or other means of getting help when it is needed. Plan definitely what action to take and how much help will be needed; a few men properly directed will accomplish more in controlling or extinguishing a fire than a large force working at random.

Fight slight surface fires by beating them out with green boughs, brooms, wet burlap, etc., or smother them with dirt. If the fire is too hot for close work, scrape away inflammable material or dig a trench ahead of the fire. Take advantage of natural vantge points, such as rock outcrops, streams, roads, etc., and connect them with lines or trenches which expose the mineral soil. If the fire is fierce, backfire towards the approaching main fire from a road or line where the backfire can be controlled. For the ordinary ground and surface fires the tools most readily available—the axe, broom, brush-hook, hoe, pick, shovel, water bucket, and burlap bag—are usually sufficient.

After a fire is controlled, guard it until it is entirely extinguished. Not even a spark should be left where the fire might start. Fires thought to be under control have broken out afresh with a change in the wind. To be safe, watch a woods fire twenty-four hours after it is apparently extinguished.

The fundamental object in preventing forest fires is to protect property, particularly buildings, fences, timber, forest plantations, etc. It should also be remembered that to suppress forest fires is an essential step in the conservation of our forest and water resources. The various States have laws making punishable the setting of forest fires, and have organizations to fight fires; but the State alone cannot at present curb all fires, and it is obviously the duty of everyone to help create public sentiment adverse to fires, and to take every possible action in their power to repress the fire evil.

Since the Pennsylvania Railroad System traverses 11 States, each with different forestry laws, its foresters give some time to making understood by operating officials just what is necessary in each locality.

FOREST UTILIZATION AND LUMBERING

While the utilization of woodlots of the Pennsylvania Railroad System is handled by stumpage sales which put the logging and manufacturing difficulties up to the contractor, the foresters of the company, through contact with the production of the railroad material listed below, are expected to know all about their grading, making, and marketing.

Material for maintenance of equipment:
- Car lumber.
- Locomotive lumber.
- Boat lumber.
- Shop lumber.
- Handles.

Material for maintenance of way and structures:
- Building lumber.
- Structural timbers.
- Ties—bridge, cross, switch.
- Piles
- Poles and cross-arms.
- Posts.
- Wire conduit, trunking, and capping.
- Wood blocks for flooring and paving.
- Handles.

WOOD TECHNOLOGY

The right use of wood—that is, the selection of the kind, quality, and size which costs the least in the long run for a specific utility, means much not only in conserving our forest resources but in reducing operating expenses in a wood-consuming industry. The knowledge of wood technology possessed by the foresters of the Pennsylvania Railroad is drawn upon in drafting of specifications for the manufacture and utilization of forest products. They maintain contact with all developments in grading standardization, and for railroad materials are in a position to get consideration for any peculiar usage which should weigh

in governing any proposed standard. Likewise to have applied as far as practicable in railroad practice the fundamental principles of timber physics developed by such organizations as the Forest Products Laboratory of the United States Forest Service. They also prepare the specifications for the preservative treatments and chemicals used, and figure the economics of preservative treatment of wood wherever the use of treated wood may be contemplated.

They have at one of the railroad's own plants a miniature apparatus for experimental treatments of single ties, to help get answers to the many questions developing in this growing and important phase of forest conservation.

The preservative treatment of wood is the largest direct contribution which railroads are making to forest conservation. They used over 85 per cent of the 150 million cubic feet per year of wood treated during the past decade. The Pennsylvania Railroad treated over 25 million cubic feet annually at several commercial plants and at two of its own. Its foresters are responsible for the proper seasoning and treating of its ties and timbers, which involves supervision of wood-preserving-plant operations in New York, New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Michigan, Texas, Kentucky, Georgia, Florida, Louisiana, Mississippi, and Minnesota.

FOREST ENGINEERING

The appraisal of damage to burned land for which the Pennsylvania Railroad System is blamed falls upon its foresters, and usually requires surveys for the purpose of mapping fire and property limits and types of forest and agricultural land. Fire lines have extended as much as 46 miles and included as many as 50 separate properties with an extensive variety of forest types.

The development of forest working plans has required land surveys, including topographic mapping of some areas not covered by United States Geological Survey work.

MANAGEMENT

Lands with trees on them or trees alone for which there seems no present or prospective need in train operation are sometimes disposed of by common carriers. The Pennsylvania Railroad uses its foresters to appraise the stumpage value of such property as a basis for its sale, and

they have to measure standing or felled trees or manufactured products, and to estimate yields. Similar mensuration is required in the exploitation of the woodlands under regulation.

Fires which occur in the vicinity of railroad tracks are frequently attributed to train operations. When claim is made against the Pennsylvania Railroad for damage to trees by fire, its foresters are called upon for an appraisal of such damage. This work in forest valuation increases in volume as the general public grows to regard as valuable vegetation which was formerly considered unworthy of attention.

ECONOMICS

The cuts and fills which are involved in the construction of railroad right-of-way over uneven terrain result in slopes which sometimes have surfaces which erode or slide to a serious extent. The foresters of the Pennsylvania Railroad apply their knowledge of vegetation to the solution of this problem and for each site and soil prescribe the kind of grass, vine, shrub, or tree most likely to stabilize the bank or slope.

Shifting sand and especially shifting snow present problems along some Pennsylvania Railroad lines, and its foresters study each situation in order to recommend suitable plants and spacing for remedying the difficulty.

Railroad station grounds are parks in many communities and the care of the trees in them involves work in aesthetics and surgery which the foresters of the Pennsylvania Railroad System supervise.

The forest resources of the sections of country tapped by the lines of a railroad concern its management not only for the wood they will provide for its consumption but for the traffic provided by the transport of raw or manufactured forest products. The knowledge of the foresters of the Pennsylvania Railroad System is useful in determining when fields on or off its lines may no longer be counted on for supplies or shipments of any kind, and whether to count on an offer of material from a foreign country.

The foresters of the Pennsylvania Railroad System are as desirous as any other foresters to maintain a sufficient supply of wood in the United States, and consequently their viewpoint, tempered by contact with railroad operation, has been sought by those proposing forest legislation, especially that involving fire control, since the development desired by all is retarded if impractical laws are passed.

CONCLUSION

The work in forestry briefly outlined above is aimed to be handled in accordance with the high standards which characterize all other engineering by the Pennsylvania Railroad. Four of the foresters now with the railroad have been in this service 16, 11, 10, and 9 years, and it is a fair assumption that they have been considered capable of undertaking more than the mere planting of trees, which phase of forestry provided the reason for the initial employment of a forester by the Pennsylvania Railroad Company.

A PROGRESS REPORT ON THE RESEEDING OF CUT-OVER LANDS TO LOBLOLLY PINE[1]

By J. A. Cope
Assistant Forester of Maryland

For the benefit of those unfamiliar with Maryland conditions, or who have, perhaps, forgotten the range-map details of collegiate days, it might be well to state that the Delaware, Maryland, Virginia peninsula marks the northern limit of the commercial range of the loblolly pine. On the sandy soils of this low-lying section of the Atlantic Coastal Plain, in Virginia, Maryland, and the southernmost county of Delaware, pure stands of loblolly pine occur, which in yield are surprisingly close to that obtained in stands several hundred miles further south in the Carolinas.

Since it is the most valuable commercial species in this section of the State, it has been a matter of chief concern to the Department to secure the establishment of pure stands of loblolly pine over as large an area as possible.

W. W. Ashe in his exhaustive treatise on "Loblolly Pine in North Carolina" makes mention of certain areas, which he terms natural or permanent loblolly pine sites, on which sites it seems conditions are such that reproduction is secured without any assistance, and thus successive crops of loblolly pine are assured. While in an extremely restricted way such sites are to be found in Maryland, in the large majority of cases the cutting of a mature crop of loblolly pine is followed by a crop of undesirable hardwoods, such as oaks, gums, and maple, unless some particular provision is made at the time of cutting to insure a seed supply and provide a suitable seed bed.

In order, therefore, to give sound and practical advice to owners of woodlands within the range of loblolly pine so they may be encouraged to take measures for securing crops of pine, the department has carried on during the last 5 years considerable investigative and experimental work with this problem.

The assurance of an abundant seed supply, which is the first step in the problem under consideration, presented no difficulties. Loblolly

[1] Delivered before the annual meeting of the Society at Baltimore, December 27, 1923.

pine seeds at 2 to 4 year intervals in the even-aged 34 year old stands that are placed on the market, so the department's recommendations were to the effect that certain marked trees should be left at the time of cutting to furnish the seed for restocking the area. Studies made throughout the Peninsula indicated that a 30 to 40 year old loblolly pine would distribute seed sufficiently thick to make a satisfactory stand (at least, 2,000 seedlings to the acre) over an area around its base about equal to the height of the tree. On the basis of an average height of 70 feet, four seed trees to the acre allows for some overlapping and provides a plentiful supply of seed.

The problem of securing proper seed bed conditions, however, is not quite so easy of solution.

The amazing rapidity with which abandoned fields seed up clearly indicate the preference of the loblolly pine to an exposed mineral soil. Studies of the past history of pure stands of loblolly pine, growing on what was evidently cut-over land, developed the fact that an accidental fire had burned over the area after logging, and thus brought about the seed bed conditions that the pine prefers.

It, therefore, seemed advisable to experiment with carefully controlled burning as a practical method of securing proper seed bed conditions.

In 1919, a 3-acre plot was laid out in a 75-year-old stand of loblolly pine, averaging about 12,000 feet to the acre, with a crown density of about .6 and a considerable understory of white and black oaks—and a dense undergrowth over the entire area, consisting of huckleberry, greenbriars, and hardwood sprouts. This location provided conditions as unfavorable to the establishment of another crop of pine as could well be found throughout the peninsula. Seed trees to the number of four to the acre were carefully marked with white paint, and the logging of the rest of the timber on the plot was completed by September 1. By special instructions to the woods foreman, it was arranged that brush from felled trees was to be removed from close proximity to seed trees without added cost.

Since this area was to be burned, it was thought advisable to make a fire line around it, and a 3-foot strip was cleared to the mineral soil around three sides of the 3-acre plot for a cost of $10. On larger areas natural fire lines such as fields, roads, streams, and swamps would generally eliminate such preliminary expense or at least distribute it over a far greater acreage. The burning was done about

the middle of September at a cost of $1.50 per acre, with most gratifying results. All the brush, lops and tops were destroyed and the mineral soil was everywhere exposed. Larger areas could be burned with the same number of men and thus reduce the charge to at least $1 per acre.

Unfortunately, 1919 was not a heavy seed year in this section, but it seemed necessary to establish the experiment, since the lumberman cooperator was cutting in the tract at this time. As a result a survey in 1920 showed only about 600 1-year seedings to the acre. These were extremely vigorous, however, many of them in mid-August being 8 to 10 inches in height.

In 1922 a resurvey of the plot indicated that in addition to the 600 seedlings per acre from the 1919 seed crop there were 700 2-year-old seedlings and 400 1-year-old seedlings. Summarized by height, there were on the plot at this time, approximately, 1,000 seedlings to the acre over 1 foot in height, and of these over 50 per cent, at least, 2 feet in height.

The hardwood sprout growth, which came up as was to be expected in great abundance in the spring following the burning averaged 3 feet in height in 1922, but in no way interfered with the seedlings of 1920, nor with those of 1921, which were 18 inches over in height. Those that were under 18 inches in height, chiefly those established in 1921, were very evidently suppressed, and it appeared extremely doubtful whether they would survive.

In order to secure definite data on this interesting point, individual seedlings, which were manifestly overtopped, were chosen at random over the area, marked by stakes, and records set down as to their condition in the fall of 1922 and again in 1923 as shown in Table 1.

This record seems to indicate that if a good distribution of seed can be secured within two years of the broadcast burning, a good stand of pine will be established, and will come through the inevitable hardwood growth without the necessity of a release cutting. If establishment is deferred to a later date, a release cutting will be necessary to secure the dominance of the pine.

TABLE 1.—*Record of Shading of Individual Seedlings of Loblolly Pine on Experimental Area in Worcester County, Maryland.*

Seedling	Year	Height	Remarks
		Inches	
1	1922	18	Underneath 30-inch sassafras, light only from north.
	1923	33	Within 6 inches of top of sassafras, vigorous thrifty-looking, leaves on stem of tree.
2	1922	23	Partially shaded by white oak sprouts 3 feet high, light only on west.
	1923	45	Top is clear of oak branches, growth vigorous.
3	1922	22	Entirely shaded by scarlet oak, seedling 3½ feet high, small amount of light from the east.
	1923	38	Oak seedling 6 feet high. Pine vigorous, breaking through side branches of oak. Bud moth in terminal bud.
4	1922	14	Shaded by sweet gum and white oak sprouts, 3 feet high. Some side light on north.
	1923	18	Oak and gum, 4 to 5 feet high. Overtopped by branches. Leaves only at top of seedling, but good color. Good terminal bud.
5	1922	12	Entirely shaded by 3-foot white oak and sassafras. Bud moth present.
	1923	24	Oak 6 feet and sassafras 3½ feet high. Light south. Fairly vigorous. Bud moth in terminal bud.
6	1922	7	Under shade of 10-inch huckleberry.
	1923	17	Terminal bud last year set back but not killed by bud moth and side bud has developed. Good specimen and should overtop brush.
7[1]	1922	3	Completely shaded by 3-foot white oak and sassafras.
	1923	6	Sickly with few leaves at top.

[1] Number 7 is the only seedling that was 1 year old in 1922. The others were 2 to 3 years of age.

TREE CLASSIFICATION IN SWEDEN

By E. J. Hanzlik [1]
U. S. Forest Service.

In permanent sample plot studies it is usually desired to keep a record of each individual tree on the plot during the entire period of examination, and in order to do this with the greatest simplicity and in such a manner as will be most easily interpreted in a mass of data by others than the investigator, it is absolutely essential that a system of recording be used that will be in accord with the above requirements. The matter of crown classification is probably one of the least tangible factors to record with which we have to do in our present method in use for this class of research, yet in the interpretation of results from a series of data the crown characteristics of the individual trees are highly important. In the sample plot work as carried on by the U. S. Forest Service and others in this country the rather indefinite terms such as dominant, co-dominant, intermediate, and suppressed are in general use; however, it is generally the opinion of foresters doing this class of research that these terms leave much to be desired in practical value, especially when the field examinations are made at different times by changing personnel. In other words, there is too much to be left to the individual judgment of the examiner in tree classification and not a sufficient basis for agreement between different examiners.

As with many other problems with which we come into contact in a new country or a new line of work, it is of advantage to see what has been accomplished by others, and in this connection it is important to note a tree classification system for recording individual trees in permanent plot work that has been devised and put into use by Prof. G. Schotte, Director of the Swedish Government Forest Experiment Station, and which appears to be such that it can be adopted in toto by American foresters.

Professor Schotte's classification [2] is based principally upon the height and location of individual trees in the stand with reference to surrounding trees, and to a lesser degree according to the form and quality of the boles. The stand is first put into four main crown classes, of which

[1] Fellow, American-Scandinavian Foundation, 1922-23.
[2] Om Gallringsförsök, Medd. fr. Statens Skogsförsöksanstalt; 1912, Sweden.

three form the upper crown canopy, and the fourth takes in the understory. These four crown classes are defined as follows:

1. Dominants—Composed of trees of dominant class; i. e., of the tallest in the stand.

2. Co-dominants—Composed of trees which are of somewhat lesser height and thinner crowns and generally more slender boles than trees of Class 1. The heights will run from about two-thirds to five-sixths of the heights of the dominant trees.

3. Suppressed—Composed of trees whose height ranges from one-half to two-thirds of the height of the trees in Class 1. The leaders are usually short and this class includes the slower growing trees of the predominating age-class in even-aged stands.

Schematic showing of the different crown and tree classes, Swedish Forest Experiment Station Classification, 1912.

4. Understory—Trees whose height does not come up to half that of Class 1. This class includes the smaller suppressed trees (of younger age in uneven-aged stands or advanced reproduction of sapling size).

In addition to the above, symbols are used to designate reproduction, (r) under sapling size, and overstandards (o), which do not properly belong in the stand. Overstandards are deemed trees of an older age class (usually 30 or 40 years older than the main stand), usually considerably taller and of greater diameter than the other trees in the stand.

The trees in each of the above crown classes are further given a classification by letter with reference to the character of the crown, and the form of bole. However, a tree with well-formed crown and with a good bole is entered without any further notation other than the number of the tree class, i. e., 1, 2, 3, or 4.

Further classification is according to the following notation:

a. Trees with one-sided crowns.

b. "Wolf" trees of better quality, with large, low-hanging branches.

c. Crooked or twisted trees, forked trees, poor quality "wolf" trees.

d. Trees with suppressed or damaged crowns due to influence of adjacent trees.

e. Sickly trees, due to insect, fungus, fire, or other damage.

f. Dead, broken or heavily snow-damaged trees.

In accordance with the above symbols, the following examples of recording are given:

1. A dominant tree of normal crown and bole.

1a. A side-suppressed tree with a half-crown in the dominant crown class.

1b. A fast-grown tree with large limbs, a better "wolf" tree in the dominant class.

1c. A decidedly crooked or limby tree of poor quality in dominant class.

2. A co-dominant tree with normal crown and bowl.

2d. A co-dominant tree with suppressed or damaged crown due to influence of adjacent trees.

3d. A suppressed tree with damaged crown.

4d. A tree in the understory whose crown is damaged through influence of adjacent tree.

4f. A dead tree in the understory.

The above symbols were adopted by the Swedish Forest Experiment Station in 1912 for recording the history of individual trees on permanent plot work, and have been found to be very satisfactory by the field and office forces. Their use obviates the necessity of more or less lengthy notations, and it sums up to the experienced observer at a glance the character of each tree, thereby allowing a ready summation of results based upon observation, and according to a standard which is fixed and which at the same time so fully covers the essentials as to be of practical value.

It is believed that this system devised by Professor Schotte is worked out on such a basis that it no doubt can be adopted bodily in most instances for use on permanent plot work in the United States. Its adoption by the United States Forest Service would, it is felt, aid materially in raising the standard of this class of research.

MANAGEMENT STUDIES ON COTTONWOOD AND SILVER MAPLE[1]

By Karl A. Swenning

Forester, Mead Pulp and Paper Company

Since the beginning of forestry in this country, government agencies and private timberland owners have been directing their attentions to the management of coniferous species of timber. And rightly so; but we are now turning our thoughts in part, at least, to the propagation and management of deciduous species. Special thought is directed toward the more rapidly growing types.

The planting and management of hardwood timber for a short rotation was begun by the Mead Pulp and Paper Company at Chillicothe, Ohio, in 1909. The species used have been of the type suitable for soda pulp manufacture—cottonwood, poplar, silver maple, and willow, all of which are of rapid-growing habit. The areas first purchased were river bottom lands, true cottonwood sites, and on these cottonwood and Carolina poplar were planted. Later land purchases and plantings were also made on river bottom lands, but due to the fact that these had been made unsuited to agriculture through serious flood washing, were available at a price far under average agricultural land values. At the present time we have under management 500 acres of timber varying in age from 1 to 15 years.

Let us now discuss briefly the three most important phases of the management of these rapidly growing hardwood species.

1. Planting, including stock and methods.
2. Management plans.
3. Present volume and yield developments with a brief discussion of conditions affecting them.

Three types of cottonwood planting stock have been used—straight cuttings, rooted cuttings, and seedlings—also straight cuttings of willow, and 1-year-old silver maple seedlings. It has been found that if the soil conditions are very favorable and that planting is followed within a very few days by rain, straight cottonwood cuttings

[1] Delivered before the annual meeting of the Society at Baltimore, December 27, 1923.

give very satisfactory results. We have secured a 94 per cent catch with these optimum conditions. When such conditions do not exist, however, the results are most unsatisfactory.

When the soil is a good sand loam mixture and where the fertile top soil has not been entirely washed away, seedlings can be successfully used. One-year-old stock, 12 to 18 inches tall, costing about $3.50 per thousand can be planted at a cost of $5.10 per thousand. The average catch is 85 per cent on the soils just described.

On poorer soils, those that have been badly washed and either the top soil entirely removed or else covered with a thick layer of sand and gravel, seedlings do not give good results. On such sites rooted cuttings must be used. The cost of growing these is high, approximately $12 per thousand, and the planting cost is much in excess of any other, averaging $8.65 per thousand. Results, however, justify the cost, for an average catch of 90 per cent can be secured. A summary of the total costs of the various types of planting may be of value: With straight cuttings, $5.40 per thousand; with rooted cuttings, $20.65 per thousand; with seedlings (1 year), $8.60 per thousand. Willow cuttings and silver maple seedlings can be planted at approximately the same cost as can those types of cottonwood stock. Maple seedlings can be raised for $1.65 per thousand.

In planting straight cuttings of willow or cottonwood, the ground is usually in such shape that the sticks can be forced into the ground without any preparatory hole being made for them. For cottonwood and silver maple seedlings a hole is made either with a spud or mattock, depending upon the looseness of the soil. Where the spud is used, one man sets the trees for two spud men, where the mattock is used one man completes the operation. Rooted cuttings, because of the extent of their root system, require the plowing of a furrough the length of the row to be set. The digging of separate holes for each plant is too long and too expensive a proposition.

Considering now that the trees are planted and have established themselves, let us discuss for a moment some of the details of management.

The operations in cottonwood have been based on a 20-year rotation. The time for cutting has been empirically set, but we believe that at the end of 20 years that the trees will have reached their maximum growth and that from then on the number of trees lost each year will balance the accruing growth. The growth peak may be reached before that time and other unforseseen factors may enter the problem,

but only by following through what we have already begun can we say definitely this or that is our best rotation.

Working on a 20-year rotation we have used two principles of thinning. With one method we thin once when the trees are 10 years old—with the other we thin twice, at 6 years and at 12 years. On one area that was thinned at 12 years we have established a sample plot with an unthinned check plot close at hand. At the time of the thinning operation:

	D.b.h., ins.	*Height, feet*
Plot A—unthinned—had 99 healthy trees	5.5	47.5
Plot B—on the thinned area had after the thinning 60 healthy trees	6.9	54.4
Today		
Plot A has 52 healthy trees	7.66	58.8
Plot B has 45 healthy trees	8.4	62.1

The obvious fact is that the two plots which 4 years ago had a difference of 39 trees now differ but seven trees. In matter of growth the thinned plot does not show any marked gain over the other. The actual loss in stumpage on the unthinned plot has been very high and on the thinned area this loss has been utilized.

Working on the basis of two thinnings we have established three conditions with check plots. First, unthinned; second, 33 per cent thinned; and third, 50 per cent thinned, or A, B, and C. The record for 3 years ago shows that on the various plots we had the following conditions:

Plot A, 444 trees, d.b.h., 2.71 inches; height..... 26.30 feet
Plot B, 304 trees, d.b.h., 2.66 inches; height..... 23.27 feet
Plot C, 261 trees, d.b.h., 3.32 inches; height..... 30.56 feet

Today the record shows:

Plot A, 415 trees, d.b.h., 3.35 inches; height..... 32.45 feet
Plot B, 289 trees, d.b.h., 3.92 inches; height..... 36.5 feet
Plot C, 257 trees, d.b.h., 4.03 inches; height..... 37.3 feet

It was hardly expected that in 3 years' time that the results of the different types of thinning would show the pronounced results that they have. The above figures seem to show very definitely that the 33 per cent thinning has an advantage over the 50 per cent thinning and a very decided advantage over the plot that was not thinned at all. Both diameter and height growth have been accelerated on the moderately thinned plot to a degree far beyond that of the other two.

The real test of the efficiency of the two methods will show to much better effect when the time comes for the second thinning.

In the present plan of management of these lands that we now own, we propose to try to produce two crops of timber from the same acre of land that before produced but one. On the typical cottonwood lands of the Mississippi River we find two conditions existing; first, those where the stand is pure cottonwood; and second, where there is a cottonwood and silver maple mixture. In the former stands the crown density is approximately .5. Under such conditions weeds grow in profusion and the ground cover is a tangled mass of grass, horse weeds and burrs of various sorts. This is typical of the condition that exists on our plantations. In the second type of stand where the cottonwood and maple are in mixture, you find the cottonwood as the dominant tree with the maple forming a solid second story below. Under such stands the ground is practically clear of weeds, all available light space is utilized for wood production and the cord wood yield per acre is increased by more than a third. Our effort now is to copy that natural mixture.

In 6-year-old stands of cottonwood 1-year-old silver maple seedlings have been under-planted. Conditions for their growth have been anything but favorable, while results secured have been most encouraging. The average catch has been 82 per cent. It is our belief that during the past 2 years these seedlings have been establishing themselves, fighting for existence. During the next year we are to watch developments and if the seedlings show promise of still better results we will continue our underplanting to other stands. On the areas that are newly planted the maples are to be introduced in the spring of the third year. We believe that by that time the cottonwoods will have developed sufficient crown so that the maples will have to reach for light, and so get away from their undersirable tendency to develop many side branches. The cottonwoods being faster growing as well, will continue the shading process indefinitely, though there is sufficient light for the maples to make their proper growth.

Having touched the high spots of our management plan, I would now like to give some of the points that have been brought out in our growth and yield studies.

A 9.5 acre tract of cottonwood, which was a part of our early planting, was cut 2 years ago. At the time of cutting the stand was 12 years old. The average diameter of the stand was determined and found to be approximately 6.8 inches. Trees as close to this diameter

as was practically possible were selected and growth studies made. The data developed follows:

Average diameter	6.8 inches
Average merchantable volume	5.128 cubic feet
Number of trees per acre	296
Yield per acre	17.04 cords
Total yield 9.5 acres	161.92 cords
Yield per acre per year	1.42 cords

Against these figures we have the data of the actual cut:

Yield per acre	16.27 cords
Total yield	154.6 cords
Yield per acre per year	1.36 cords

In the original planting where the trees were set 4.5 by 9 feet apart we had 1,076 trees per acre—at 12 years there were 296, showing a loss of 72.5 per cent. A thinning was made in these trees about 6 years ago, but due to the fact that no record was made of the actual amount of the thinning we must take the 72.5 per cent as the actual loss in trees.

The costs of growing this timber may be of interest:

Planting cost, interest, supervision		$1,310.08
Yield		154.6 cords
Cost per cord	$8.47	
Cutting	1.62	$11.35
Hauling to the mill	1.26	

Three years ago a thinning operation was carried out on one of the best of our plantations and a growth study was made on trees cut at that time. The figures which resulted show a higher yield than we found in the cutting of the previous year.

A growth curve was drawn and projected to 20 years, the rotation basis for our operations. Yields for 16, 18, 20 years have been taken from this curve.

For 16 years	27.07 cords per acre
For 18 years	29.52 cords per acre
For 20 years	31.07 cords per acre

The curve shows a theoretical diameter of 6.2 inches at 11 years; at 14 years, 7 inches; and at 15 years, 7.3 inches. Actual measurements at the age of 14 years give the average as 6.97 inches and at 15 years as 7.65 inches, checking our theoretical extension in a very satisfactory manner.

In an effort to determine the condition of our stands in comparison with pure natural stands of cottonwood, we have run several quarter acre plots on some of the Mississippi River island lands. We find that 15-year-old natural stands have an average of 208 trees per acre, an average d. b. h. of 8.93 inches and an average height of 62.5 feet. In diameter and height the trees that have been grown under plantation conditions compare most favorably with the natural stand. The greatest difference is in the stand per acre, our best averaging 50 per cent more—other of our stands will run about 200 trees per acre. It is on this point that the success or failure of our management rests. During the past 3 years the mortality rate in some of our plantings has been extremely high, even in those stands that were thought to be thinned enough to allow every tree standing to develop to maturity. If in the next 3 years, the trees continue to die at the same rate as for the past 3 years, our predictions of yield must be materially changed. Some of our soils can be made to produce better stands than those that grow naturally on the Mississippi River bottoms, others cannot do as well. Pure stands of any species can thrive only to the limit of the ability of the soil to produce that species.

We have one avenue of work that is still open to us. The planted stands that we have been considering were not thinned until they were ten years old. It is our belief that with the two thinnings that we are now using we can so establish those trees that are left at the end of the second thinning, that the mortality from that time to maturity will be of but little importance.

A brief resume of the essential facts given may be of interest.

1. Cottonwood seedlings, maple seedlings, and rooted cottonwood cuttings have proven to be the most satisfactory planting stock.

2. The rotation basis for cottonwood for pulp wood purposes has been empirically placed at 20 years.

3. The under-planting of cottonwood with silver maple shows evidence of good future possibilities.

4. Two methods of thinnings are being tried, with one showing decided advantages over the other.

5. In fair stands of 12-year-old cottonwood we have secured a yield of 1.36 cords per acre per year.

6. In average stands of cottonwood we anticipate a yield of 1.5 cords per acre per year.

7. Planted stands of cottonwood compare favorably in growth with natural stands.

REFORESTATION PROGRESS AND COSTS IN SOUTHWESTERN PENNSYLVANIA[1]

By Walter D. Ludwig

District Forester, Johnstown, Pa.

This paper is the third of a series which the author has so far prepared with particular reference to forest conditions and the necessity for intensive reforestation work in southwestern Pennsylvania. This region is the hub of the soft coal and steel industry in the State and the location of so many other great industries that it may be called unique among eastern centers of population. No other section except the Ruhr in Germany presents such diversified and intensive industrial development and for this reason the area is especially interesting and worthy of study as to what measures must be taken to insure this continued industrial activity and the future well being and prosperity of the region itself.

In these papers the author already noted that the area consumes about 1,000,000,000 board feet of timber annually and that the mining industry alone requires about one-third of this amount. Furthermore, it was pointed out that the native forests of the region are growing only one-tenth of the annual consumption; that it will be necessary to retain in forest the present area of 1,000,000 acres of woodland; that the 400,000 acres of brush land now producing no timber must be carefully managed, and the 300,000 acres of abandoned land must be reforested as the start of a forestry program destined to make the region eventually self supporting in the matter of its timber requirements.

Accurate records of reforestation work are available since 1916 and before that time so little such work has been done that it may be disregarded entirely. These records show that only one-thirtieth of the area which must be reforested annually has been so treated and that this work must be rapidly increased before even a small beginning is made in the proposed reforestation program alone.

[1] Delivered before the annual meeting of the Society at Baltimore, December 27, 1923.

REFORESTATION SUCCESSFUL

To answer the first question always asked relative to the success of reforestation work so far done, the author can say emphatically that such work has been done most satisfactorily and can be done with every chance of success in accordance with established forestry practice.

In order to determine how successful existing plantations are and to furnish accurate data, almost 50 of the larger and most typical plantations were examined this fall and early winter.

Measurements were made of almost 6,000 trees as well as notes taken on the percentage of establishment, and other data so that the tabulated results given in this paper are accurate and comprehensive.

The table given herewith shows exactly how representative plantations are thriving throughout the district and that the various species used in the work are growing normally and satisfactorily. It is interesting to note further that the average percentage of establishment of all species and plantations is about 83 per cent, indicating an average which compares very favorably with others established elsewhere throughout the United States:

Species	Age of planting stock	Total height	Current annual height growth	Average annual height growth	Number of trees measured	Percentage establishment	Remarks
1903[1]	*Years*						
Norway spruce.	4	28.8	.99	1.37	21	65	Windbreak
1906							
Norway spruce.	4	22.8	1.64	1.26	25	90	Windbreak
White pine.....	4	22.3	1.9	1.24	55	80	Watershed
Scotch pine....	4	23.0	1.5	1.28	57	80	Watershed
1911							
White pine.....	3	13.8	2.8	1.07	21	75	Swampy area
1915							
White pine.....	3	8.58	2.27	.96	149	85	Hillside
1916							
White pine.....	3	7.28	2.0	.91	176	85	Hillside
White pine.....	2	6.5	1.7	.81	96	95	Windbreak
Scotch pine....	2	8.3	2.0	1.04	96	95	Windbreak
Pitch pine.....	2	6.8	1.6	.85	66	95	Windbreak
1917							
White pine.....	2	3.84	1.27	.55	102	60	Watershed

[1] Year planted.

Species	Age of planting stock	Total height	Current annual height growth	Average annual height growth	Number of trees measured	Percentage establishment	Remarks
1918	*Years*						
Norway spruce.	3	2.5	.51	.42	180	90	Windbreak
White pine.....	3	4.5	1.0	.75	155	90	Windbreak
Scotch pine....	2	3.46	.82	.58	84	60	Watershed
European larch.	3	6.23	1.67	1.04	107	90	Windbreak
1919							
Norway spruce.	3	1.25	.31	.25	66	52	Old farm land
White pine.....	3	2.0	.8	.4	66	73	Old farm land
Banks pine.....	3	4.1	1.6	.82	52	72	Old farm land
Red pine.....	3	1.7	.72	.34	368	83	Old farm land
Red pine.....	3	2.8	.91	.56	47	90	Windbreak
1920							
Norway spruce.	4	.89	.20	.23	327	79	Heavy cover
Norway spruce.	4	2.75	.5	.69	112	65	Heavy cover
Norway spruce.	3	.8	.2	.2	50	90	Rocky area
Norway spruce.	3	2.15	.61	.54	47	90	Old farm land
White pine.....	3	1.18	.31	.30	189	85	Heavy cover
White pine.....	4	2.67	1.0	.67	110	65	Heavy cover
White pine.....	2	1.35	.53	.34	169	94	Open field
White pine.....	3	2.15	.81	.54	114	90	Rocky area
White pine.....	3	2.36	.92	.59	12	85	Old farm land
Scotch pine....	3	2.55	.60	.63	196	87	Heavy cover
Pitch pine.....	4	2.36	1.62	.59	47	60	Old farm land
European larch.	3	3.97	1.37	.99	24	80	Old farm land
Banks pine.....	3	3.97	.98	.99	244	88	Open field
Banks pine.....	3	2.83	.93	.71	35	82	Open field
Banks pine.....	3	3.39	1.20	.85	158	88	Heavy cover
Banks pine.....	3	2.7	.85	.67	27	60	Old farm land
Banks pine.....	3	3.12	1.16	.78	140	85	Open field
Banks pine.....	3	3.87	1.3	.97	51	85	Old farm land
Red pine.....	3	2.6	.81	.65	25	85	Old farm land
1921							
Norway spruce.	2	.96	.25	.32	179	95	Open field
White pine.....	3	2.12	.66	.71	443	90	Hillside
1922							
White Pine...	2	.55	.21	.27	146	85	Heavy cover
1923							
Jap. red pine..	2	1.30	.52	....	60	95	Open field
Jap. red pine..	2	.85	.32	....	137	95	Light cover
Jap. black pine.	2	.93	.28	....	155	95	Light cover

All measurements in feet and tenths.

ACTUAL GROWTH CURVES

To serve as a guide for future reforestation projects the author has prepared from the data and records a graph (too large to be repro-

duced here) so that later plantations may be compared to determine whether they are progressing satisfactorily. This graph will not only serve as a reliable guide to those carrying out reforestation work, but it also brings out several points of more than ordinary interest to foresters.

It shows conclusively, for instance, that while white pine grows more slowly in youth than Scotch pine, yet when about 20 years of age the white pine makes a larger current annual growth than the Scotch species, plainly indicating that the former will soon exceed the latter. It proves further that Norway spruce, while slow growing in youth, bids fair to compare very favorably with the native white pine. Other data brought out in the graph do not present any facts not now generally known to foresters. It will be interesting and of great scientific value to watch and study the future growth of the Japanese red and black pines which are being used in reforestation projects. While these species have not been planted sufficiently long to furnish any accurate indication of what may be expected, yet they do seem to promise something worth while in their remarkable growth in the first few years after planting.

The table and graph seem to indicate that there is little or no difference in the future growth and success of the plantations arising from the age of the planting stock. While the older stock appears to make an earlier start in growth, yet over a decade or two the results are not sufficiently better to warrant the additional cost of older planting stock than the average of two to three years.

Owing to the fact that there are not sufficient plantations of hardwoods over the region to furnish an accurate index, these species are not included in the table given in the paper and the graph.

In order that there may be no misunderstanding or confusion as to the species noted there is given herewith the common and scientific names of each of them: White pine, *Pinus strobus;* red pine, *Pinus resinosa;* Scotch pine, *Pinus sylvestris;* Pitch pine, *Pinus risida;* Banks pine, *Pinus banksiana;* Japanese red pine, *Pinus densiflora;* Japanese black pine, *Pinus thunbergii;* Norway spruce, *Picea excelsa;* European larch, *Larix europea.*

REFORESTATION COSTS

Owing to the general high rate of wage throughout the region, reforestation costs are somewhat above the average elsewhere, but not

sufficiently high to make the operation prohibitive from a forestry and financial standpoint. Calculating on continued good growth as noted in the records in this paper it is certain that some returns can be had in the way of thinnings at 25 years of age. Even now at 18 years after planting many mine props and ties could be cut from white and Scotch pine plantations without impairing the future status of the areas.

Figures gathered together show that the cost of reforestation work so far done ranges from $4.30 to $18.30 a thousand trees planted, not counting, however, the actual cost of planting stock. Figuring on a spacing of 5 by 5 feet, which represents the average over the region, it is evident that the acre cost of reforestation will range from $7 to $30.

These figures do not include the actual cost of planting stock because the State Department of Forests and Waters furnished most of the seedlings used under a special law permitting it so to distribute forest tree seedlings for reforestation work within the State at a nominal sum to cover the costs of packing and shipping. Where a comparison is desired with similar costs elsewhere, these can be computed easily by adding to these figures an average cost for planting stock when purchased from reputable commercial nurseries.

These average costs for reforestation projects compare favorably with similar costs elsewhere and so can be expected to yield a rate of interest on the investment usually calculated upon for forestry work generally. It must not be overlooked, however, that financial returns will be considerably enhanced within the next quarter century in southwestern Pennsylvania because of its continued industrial and economic development due to the enormous reserve supply of soft coal underlying the whole area.

At the same time reforestation has been generally free from serious insect and fungus injuries. More to be guarded against in the work are the destruction and harm from cattle and from establishing plantations too close to the smoke and gases from steel mills and coke ovens. Fortunately the wasteful bee hive oven is being rapidly replaced by the more efficient and economical retort oven so that the smoke danger should materially decrease in future years. The only way to protect against grazing is to fence such young plantations and maintain such protection for an average of about 10 years when there will be little further danger from such injuries.

Reforestation is more than profitable with ready markets within the region, with the assurance of increasing industrial vigor not equalled

in the country and with the knowledge that when the trees are planted properly they have every chance of success. It is no longer an experiment, but an established fact and should take its proper place among the recognized necessary and essential activities of southwestern Pennsylvania.

NOTE.—The author desires to acknowledge the great help and assistance rendered by Assistant Forester T. I. Shirey in the collection of the field data and measurements necessary to compile the tables in this paper.

COMPARISON OF THE VOLUMES OF VIRGIN WHITE PINE STANDS IN PENNSYLVANIA[1]

By Reginald R. Chaffee
Forester, Wheeler & Dusenbury

In a time and period in which the Pittsburgh district alone is consuming more lumber than is produced in the entire State of Pennsylvania, there still remains two commercial stands of virgin white pine in the Pennsylvania white pine region—the cork pine of the Alleghenies and the Clarion River pine; both recognized as such even in the early rafting days when lumber was sold from the river banks from Pittsburgh to Louisville, Ky., occasionally farther South.

It has been stated by many lumbermen of the last generation that white pine reached its optimum development on the headwaters of the Allegheny.

One of these stands is located in Warren County, and is comprised of a body of timber slightly less than 1,000 acres. The other one, a stand of only 200 acres, is located in Forest County.

The former is probably from 75 to 100 years older than the latter. According to studies made by Dr. MacDouglas, of the University of Arizona, and the writer, the average age of the largest trees in Warren County is from 350 to 400 years; few getting over 375.

The necessity arising for a close study in comparison of volumes, the diameters, number of trees, grades, etc., was made by request of the Timber Valuation Section of the Internal Revenue Department. At the time of the taking of the data and making up these comparisons in Forest Country tract, two 10-chain strips of one acre each were taken, and one square acre was located where the trees seemed to indicate greatest volume. The party consisted of members of the Forest Service, owners of the tract, and a crew of estimators headed by the writer. The judgment as to the heaviest stands was left entirely to the owners of the tract. Because of the smallness of the area involved and first-hand information it would naturally seem that there could be no doubt as to the best areas available having been taken.

[1] Presented at the annual meeting of the Society at Baltimore, December 28, 1923.

TABLE 1.—*White Pine—Warren and Forest County Tracts. (Comparison of Volume in Board Measure per Acre and Relative Density of Group Diameter Classes)*

Group	Tract	Strip 1			Strip 2			Strip 3			Square Acre			Average Acre			
		No. trees	Per cent in class	Total volume	No. trees	Per cent in class	Total volume	No. trees	Per cent in class	Total volume	No. trees	Per cent in class	Total volume	No. trees	Per cent in class	Total volume	Per cent of volume
I																	
10″	Warren	6	14	1,950	9	20	3,645	4	15	1,850	1	4	405	5	14	1,962	4
to	Forest	8	33	3,680	13	33	4,810	.....	.....	.....	28	44	10,360	16	38	6,283	20
24″																	
II																	
25″	Warren	24	55	27,480	19	41	21,755	14	54	14,140	7	29	8,680	16	46	18,014	37
to	Forest	15	63	13,950	25	64	21,500	.....	.....	.....	32	51	29,440	24	57	21,630	70
30″																	
III																	
31″	Warren	13	30	23,140	18	39	37,800	8	31	17,500	16	67	36,960	14	40	28,850	59
to	Forest	1	4	1,325	1	3	2,660	.....	.....	.....	3	5	4,995	2	5	2,993	10
41″																	
Totals	Warren	43	100	52,575	46	100	63,200	26	100	33,490	24	100	46,045	35	100	48,826	100
	Forest	24	100	18,955	39	100	28,970	.....	.....	.....	63	100	44,895	42	100	30,906	100

In case of the tract in Warren County, the same estimators were used and the stands involved and the measurements taken were not so carefully selected as to greatest volume as was the case of the smaller area. So the writer feels that the latter figures are very representative of the average stands within the confine of the stand in Warren County.

Tabulated results are found in Table 1.

A number of tables have been prepared, only one of which is here presented, showing the results of these investigations and are, in the main, self explanatory. In order to show the differences more strikingly the arbitrary group method was used in making up the diameter classes, the same ranges of diameters being shown in both stands.

As would naturally be expected, the results obtained as to volume were not nearly so striking in their differences in quantity as in quality. In as much as in any healthy body of virgin timber the diameter is a fair indicator of quality; the figures obtained as to ranges of diameter and number of trees within the diameter classes of the two stands showed remarkable differences as to quality.

The most striking factors presented in the table submitted are the facts that in the third group the largest diameter class, the number of trees in the smaller tract were practically nil; whereas, in the larger tract this group showed the largest number of trees and practically the bulk of the volume of the stand.

In drawing the parallel between these two tracts of timber two outstanding features present themselves. First, the differences in age not shown by the tables, and, second, the differences in quality which, although not at all conclusive, would bear out the statement of the lumbermen, both of the present and of the past, that white pine more nearly reached its optimum development and showed greatest per cent of quality cuts; that is, selects and uppers and clear grades, than that of the Clarion River district.

NOTE.—In the original work and tables prepared the presence of both hemlock and mixed hardwoods were considered and estimated, but for the purposes of this article and the points involved, it seemed unnecessary to include or discuss, as the percentage of mixture and quantity were very much the same.

THE PRESENT STATUS OF THE CHESTNUT BLIGHT[1]

By G. F. Gravatt

U. S. Department of Agriculture.

The chestnut blight, a fungus disease native to China and Japan, was first noticed in this country at New York City in 1904. Since that time the disease has spread steadily until now it has practically covered all of the chestnut growth of the New England States and New York. Its spread westward across Pennsylvania was retarded by the work of the Pennsylvania Chestnut Blight Commission and by the fact that the disease naturally spreads at a slower rate westward across the ridges than southward.

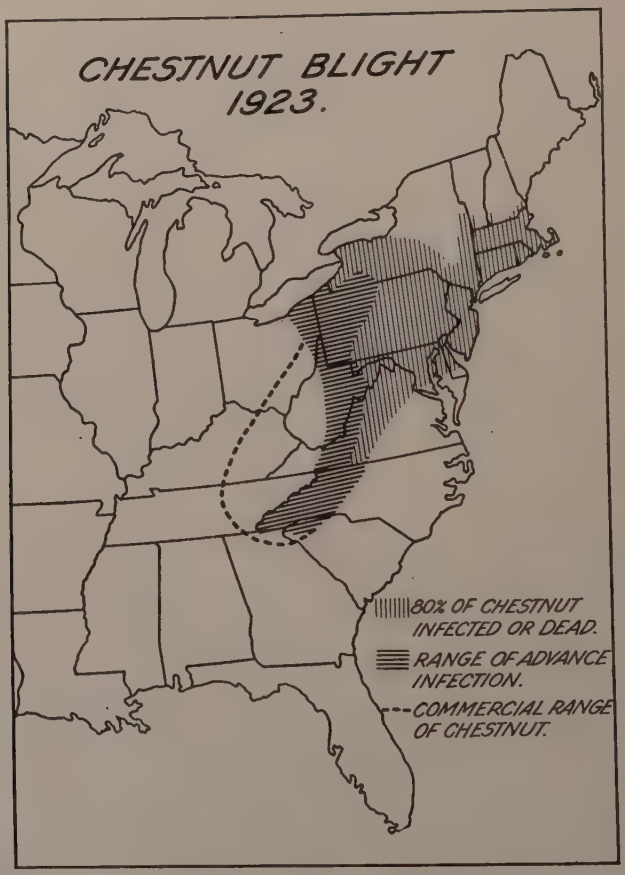
The disease has spread southward at a very rapid rate. In 1913, the zone of heavy infection had not yet reached Virginia, but in 1923, as shown by the map of the present distribution, this zone of heavy infection had reached North Carolina. The disease thus spread southward across Virginia, a distance of 240 miles, in 10 years, or at an average rate of 24 miles per year. We have watched the spread of the blight across Virginia and can say that this spread was not due to any exceptional infections. On the contrary, the spread took place despite the fact that a number of the more advanced infections were removed to delay its progress.

Though it is expected that the spread of the disease westward across the mountains and at higher elevations will be much slower than on the east slopes of the Blue Ridge Mountains in Virginia and North Carolina, there is no reason to expect that anything will prevent the death of the remaining chestnut stand. Forecasts based upon the various factors have been prepared for the Southern Appalachians showing when we expect the chestnut growth of different sections to be killed. We publish these forecasts with hesitation and reservation, as there is such a large probable error in them due primarily to our limited knowledge of the present distribution of the blight. For instance, a large advance infection was found in South Carolina this past summer. This infection started from an infected nursery tree or in some other way, probably as early as 1912, at which time the main infection area had not even

[1] Delivered before the annual meeting of the Society at Baltimore, December 28, 1923.

reached Virginia. This large infection in South Carolina completely changed our forecasts for a large area in the Southern Appalachians, and we fear that large unknown infections may be present in other states.

The map showing the distribution of the disease in 1923 is based upon only a few months of field inspection work as funds available for



work on chestnut blight are limited. We are indebted to many foresters, pathologists, and private individuals for information assisting in preparation of this map; additional information regarding the distribution of the blight in different sections of the country will be gratefully received.

The rapid spread of the chestnut blight into the Southern Appalachians means a very heavy loss in value of standing timber. Various reasons such as glutted local markets, lack of available labor and sawmills, and absentee ownership prevent many owners from utilizing their trees before deterioration causes very heavy loss. Foresters estimate this loss in different parts of the country as ranging from 10 to 40 per cent of the value of the standing timber. We are facing such a loss on thirty million acres in the Southern Appalachians containing an average of 25 per cent chestnut. Additional field studies are needed on rate of spread, rate of deterioration of killed trees, and utilization studies to provide the extension forester and owners with accurate information needed to prevent as much of this loss as possible.

The passing of our native chestnut will cause many economic disturbances. Within the past week two large consumers of chestnut poles have discussed with considerable alarm the present status and future of this industry. For example, the local supply of poles in Connecticut is rapidly drawing to an end, and such areas are faced with heavy transportation charges on poles brought from long distances. Another large industry is the manufacture of chestnut extract. These chestnut extracts furnish approximately one-half of our production of all vegetable tanning materials. The other important sources from which we derive native vegetable tanning materials are hemlock and chestnut oak barks. As there is little prospect of any material increase in the supply of eastern hemlock or chestnut oak barks, and the present stands of chestnut will be killed with no prospect of any natural reproduction of chestnut, we face the prospect of the vital tanning industry becoming dependent upon quebracho and other foreign tanning extracts. The tanning of leather is one of our large basic industries which should not become dependent for its raw material upon some foreign source of supply.

Some American chestnut trees have been found by Dr. A. H. Graves around New York City which are still alive. We are propagating from these trees with the possibility that by selection or breeding an American chestnut strain resistant to the blight may be secured. Many years will be required for definite results from these experiments. Long periods of severe exposure to the blight are necessary to determine the value of a tree, as often a tree will throw off the infections for a number of years and then suddenly succumb to the disease.

In our tests of the different exotic species of chestnut, the hairy Chinese chestnut, *Castanea mollissima,* is one of the few species which we have had under observation sufficiently long to give definite indication as to its resistance to the blight. This species in our experimental test plot at Bell, Md., has made fairly rapid growth and has shown a fair degree of resistance to the blight when grown under favorable conditions. Further extended tests are necessary before a final statement can be made on this tree and even if found sufficiently blight resistant to grow to large size their value to forestry is yet to be determined. Two small plantings of this tree have been made on the National Forests in cooperation with the Forest Service. Preliminary tests of tanning content of wood indicate that it will equal that of the American chestnut. A number of other much more promising species from a forestry standpoint, some of which grow to a height of 100 feet in China, are under test, but it will be some years before results will be available.

SOME NOTES ON THE FORESTS OF NORTHERN RUSSIA[1]

By John D. Guthrie

Assistant District Forester, Portland, Oreg.

Russia is a country of immense areas and great distances. Pre-war Russia (European) was divided into 60 provinces which occupied over one-half of the continental Europe. While very unevenly distributed, her forested area is estimated to cover some 257,500,000 acres, or about 36 per cent of her total land area. Zon [2] estimates that the total forested area of what was formerly the Russian Empire at 511,015,000 acres.[3] The provinces of Archangel and Vologda alone are estimated to contain 148 million acres of forests. Whatever form of government she may eventually choose, Russia and her forests must be considered in any world survey of timber resources, for within her confines is one of the three great bodies of remaining coniferous timber of the world. Therefore her forests should be of interest to every forester.

This article deals primarily with the province of Archangel, in European Russia. This province contains 213,163,200 acres or an area about equal to the combined areas of the States of Texas and Missouri. Of this total area 44 per cent is in forests.

TOPOGRAPHY AND PHYSICAL FEATURES

The province of Archangel lies around the White Sea, stretching from the Ural Mountains on the east to Finland on the west, including the Kola Peninsula and a part of Lapland and the large island of Nova Zembla in the Arctic Ocean. Described roughly, it may be said to be a border 300 miles in width (north and south) that stretches across the extreme north of European Russia from Siberia on the east to Finland on the west. About one-third of the province lies

[1] Data based largely on notes and observations made during three months in Archangel in 1919, as engineer officer attached to the General Staff, 85th Division, A. E. F., North Russia.

[2] Forest Resources of the World, Zon and Sparhawk, 1923.

[3] Compare with estimate of 822 million acres of original forest area of United States and the 138 million acres of virgin forests now remaining.

within the Arctic Circle. The province is included in what is known as Great Russia. The country is for the most part flat, with many swamps and lakes. The Chibinksy Mountains (3,000 feet elevation) in Lapland in the western part of the Province and the extensive Timan Range in the eastern portion are the only elevations of importance. There are several large rivers flowing north through the Province into the White Sea and the Arctic Ocean, the North Dvina and Pechora being the two largest with the Mezen, the Onega, the Kem, and the Kola as secondary. The Province is traversed by two railroads, one running from Archangel due south striking the Petrograd-Siberian line at Vologda and in operation for some years prior to the World War; and the other from Murmansk (on Kola Bay, an arm of the Arctic Ocean) south connecting with the Petrograd-Siberian line at Zvanka, 660 miles in length constructed during the World War largely by Austrian and German war prisoners.

CLIMATE

The indirect influence of the Gulf stream is noticeable on the Murman Coast giving Russia her only ice-free winter harbor on the north of Murmansk. Further east in the White Sea region the climate is rigorous with great extremes. The White Sea is ordinarily frozen over from about November until April. The mean annual temperature at Archangel is 31° F.; mean maximum 85° F., with a mean annual minimum of 31° F. The annual precipitation averages 15 inches, heaviest from August to November. On an average there are 50 days during the year with snow; during only three months may no snow be expected, July, August and September.

After a long and severe winter (10 to 50 below zero), the ice goes out of the rivers with a rush toward the midle of May and the summer with its high temperatures comes suddenly, the peasant discards his padded clothing for light summer wear, the birds return, and everything seems to become green almost over night; there is no spring. Growth proceeds rapidly. Grain ripens in August and by the end of that month autumn begins. The first snows come in October, by November many of the rivers are frozen, and by December all bodies of water are ice-bound for the long, dark northern winter until the following April or May.

THE ARCTIC REGION

As previously mentioned, one-third of the Province of Archangel is within the Arctic Region. This is the tundra country for the most part beyond the northern limit of forests, though the Scots pine on the Kola Peninsula extends almost to the shores of the Arctic Ocean (70 degrees N.). The shortness of the summer, lack of drainage and the depth to which the soil freezes during the long winters determine the character of the vegetation. The cover consists of birch, alder, willow and several shrubs, all more or less dwarfed. Mosses and lichens are abundant.

THE FOREST

The forests of European Russia are roughly 85 per cent conifers and 15 per cent hardwoods and are generally divided into three broad regions: (1) Northern coniferous; (2) Mixed coniferous and hardwoods; (3) Hardwoods.

The northern coniferous forest (with which this article deals) is made up of Scots pine (*Pinus sylvestris*), Norway spruce (*Picea excelsa*), larch (*Larix decidua Europaea*), and fir (*Abies pectata*), and unimportant hardwoods such as four species of birch, two species of alder, and several willows. Other than cut-over strips along the railroads and the larger rivers and the area occupied by lakes and swamps, the region may be said to be entirely covered by virgin forests. The province of Archangel is rated with the highest forest area per capita, 171.3 acres, and 44.6 per cent under forest, of any in European Russia. Olenetz Province is second with 32.5 acres per capita and 47.6 per cent in forest. The province of Vologda has the highest percentage in forest, 81.8 per cent, but with a much larger population has only 19 acres per capita. The pine and larch are for the most part practically even-aged, the spruce showing far more variety in age classes. This is accounted for by extensive forest fires which swept over a large part of North Russia about 1730, preceded by a great drought-period during the 17th century, which is a matter of historical record. Water courses are supposed to have protected to some extent the spruce in many localities which accounts for the greater age and greater variety of age classes of this species.

Partly frozen or rocky soil, very low temperatures, a short growing season, combine to make tree growth a slow process. Some twenty-

three-foot pine logs at a mill at Archangel were 150 to 170 years old and average about 18 inches at the top end. Larger logs than this were very apt to be defective. The forest is subject to injury from many sources—fire, frost, wind.

OWNERSHIP

Prior to 1917 for Russia as a whole forest ownership was about as follows: State, 67 per cent; private, 24 per cent; peasant, 8 per cent; all other, 1 per cent.

In the province of Archangel before the Revolution of 1917 the State was the owner of practically 90 per cent of the forested area. Since 1917 all forest land has been nationalized.

EXPLOITATION

With an immense forest area, only two railroads, a scanty population, methods used to harvest the timber crop naturally are typical of a pioneer region. The government timber is sold by the tree. The selection system is used generally throughout except on the few private or peasant holdings where fuel-wood areas are often cut clean. All lumbering is carried on by large timber companies who contract the felling, hauling and rafting to local peasants. The felling and hauling (horses and sleds) to the rivers are done during the winter. Usually the trees are barked and logs cut in 22-foot lengths and piled along the river banks awaiting the break-up. No disposition is made of the tops, limbs or bark. In the spring about the time that the ice breaks up the river-driver or *splavtchick* comes with his *artel* (or group of woodsmen) and dumps the logs into the streams. Further down if the stream is a large one they are caught by booms and tied together and converted into rafts holding from 300 to 1,000 logs each. The rafts go down to the mills, located usually on the White Sea or some of its numerous gulfs, where they are hauled up and piled ready to be sawn during the remainder of the year. From the mills the product goes directly into ocean-going vessels for England, France and other European markets.

The timber companies prefer logs from 12 to 18 inches in diameter (top end—22-foot logs) as the larger trees are apt to have heart-shake (*mitick*). Some companies refuse to cut trees over 20 inches in

diameter claiming that they have heart rot and not worth taking out, also the "frames" or gang-saws are usually not made to saw logs larger than this.

GOVERNMENT RESTRICTIONS

Stumps were not to be cut over 28 inches high; if cut higher twice the value of the tree is charged. On portions of the Onega River one restriction was that no timber was to be felled within 6 versts (3.9 miles) of the river or its tributaries. This was to afford protection to the river banks and to keep the stream from forming new channels.

One timber company had 20 years to cut, with the right to cut not less than 60,000 nor more than 200,000 trees annually.[4] Advance partial payment was required of the purchaser. The companies contract all woods work with local peasants, always dealing with one individual who acts for his group of workmen or *artel,* a system said to prevail universally throughout Russia. The selection of the cutting or sale area is made by government foresters as well as the marking of the trees to be cut. In some parts of Archangel the government foresters had in times past attempted conducting their own logging operations but this proved unprofitable.

Prescriptive rights of communes and villages had heretofore been a thorn in the foresters' flesh as they have proved to be throughout Europe. Considerable progress had been made in Archangel Province, however, to eliminate these through various arrangements, such as what we would call free-use to the peasants of so many logs in place. The nationalizing of the forests naturally has brought to naught all such efforts of pre-revolutionary days.

FOREST FIRES

In spite of the very heavy snowfall and the low temperatures of a northern climate and the presence of many bodies of water, forest fires have taken a heavy toll of this great forest region throughout past centuries. Like all countries with Arctic conditions the summers are short but characterized by almost 24 hours of intense sunlight

[4] An English officer who was in the timber in North Russia prior to 1914 told me that he had been offered a million trees on a contract but that it meant the construction of many miles of railroad and that therefore he had not taken it.

during which much of the vegetation becomes dry and inflammable. At Archangel the shortest day of the year is 3 hours and 12 minutes while the longest is 21 hours and 48 minutes. This is much the same situation as is found in the interior of Alaska where fire annually destroys large areas of forest. In fact, Archangel, Russia, and Fairbanks, Alaska, are about the same latitude and in many other respects (especially mosquitoes!) the two regions are not dissimilar.

The forest and general literature [5] of Russia have many references to forest fires occurring in that region. Evidences of past fires are readily discernible in the forest practically throughout northern Russia.

In a region of such extensive forests with a fire risk apt to occur from time to time in the villages as well as in the forest, the Russian foresters have in times past put into effect certain forest fire rules and regulations. For example, in most of the forest villages there is in each house a small card or notice posted bearing a picture of an axe, a horse, barrel of water and sundry other items, the purpose being a notice to the occupant or owner that in case of a fire either in the village or in the adjoining forest the pictured articles were expected to be brought to the fire to help in putting it out. With over 85 per cent of the total peasant population unable to read or write the significance of having the items on the notice *pictured* is evident.

In almost every village, which are constructed entirely of logs, there are watch towers, generally built on some public building, as well as barrels filled with water placed at strategic places, to be used in case of a fire. These towers served a valuable military use during the Allied occupation of North Russia in 1918-9 as vantage points from which many movements of the Bolsheviki Army along the railroads and rivers could be learned.

AN ARCHANGEL SAWMILL

On the shores of the various bays and gulfs of the White Sea many sawmills were to be found in 1919, and principally at the towns of Kem, Soroka, Onega and Archangel; in the vicinity of Archangel at the mouth of the Dvine River there were between 40 and 50. At Murmansk I saw some 500,000 feet of very good pine lumber, 1, 2,

[5] "Free Russia," by Hepworth Dixon; "Forestry of Northern Russia," by J. C. Brown; "Forest Rambles in Swedish Lapland," in British Journal of Forestry, Sept., 1882; "Travels of a Naturalist in Northern Europe, by J. R. Harvie-Brown, Vol. II.

and 4 inch boards and 12 and 16 feet in length, clear stuff, sawed at mills at Soroka, 400 miles to the south. Here also were immense piles of fuel wood, round, 4-foot stuff, apparently tops, hauled by railroad from Soroka.

Most of the sawmills at Archangel (population of 120,000 in 1919) were owned by English capital and before the war largely managed and run by the English, with native labor. Company C of the 310 Engineers, A. E. F. N. R., took over and ran one of these mills at Solombola to supply material for barracks, storehouses, road building, etc., which the American engineer troops constructed for use of the Allies at Archangel and nearby towns. The number of houses in Archangel was said to have doubled during the war; during 1918 and 19 the city had a large refugé population from Vologda, Moscow and Petrograd, in addition to some 15,000 in the Allied Armies, hence the necesity for providing living quarters.

One sawmill about 5 versts (3.3 miles) from Archangel which was inspected was being run by a Russian forester (M. M. Levin) during 1919 and was cutting about 200,000 feet per day. This mill was considered an up-to-date one for this region. All machinery was of Swedish make (Dolinder, of Stockholm,—other Swedish makes are also used here), all sawdust and most of the edgings were burned, chain feed and chutes taking this fuel directly into the burners. All saws were "frame" or gang saws, there being six in this particular mill, the whole log being run through without first being slabbed or cut into cants. The gang saws were used almost exclusively in the mills of the White Sea region. With sound logs perfectly straight and with little taper the frame or gang saw is efficient, otherwise there is a great deal of waste. Forester Levin informed me that with the timber he was cutting the waste would run at times as high as 50 per cent of the log. This mill was located directly on the bay, the logs being taken into the mill from the boom by a chain haul-up, the lumber being loaded directly from the docks into ocean-going freighters.[6] To one side of the mill was an immense rick of logs (mostly pine, some spruce and larch) several hundred feet in height. The plant was equipped with planers, and edgers. There was a very large accumulation of slabs and edgings, in fact, most of the sawmills, yards and lumber plants about Archangel Bay were built up on "made

[6] Prior to 1914, France secured almost one-half of her lumber supply from Russia.

ground" of slabs and edgings, in some cases 50 to 100 feet in depth. There was a very large stock of good quality lumber in the yards all air dried, no dry-kilns having been seen in the Archangel region. Archangel's lumber trade prior to 1917, was very heavy, lumber, with fish and flax being her principal exports. With the resumption of trade relations with the other nations of Europe which has already begun, and which must inevitably reach far larger proportions than those of pre-revolutionary days, Russia's forests are destined to play a most important part in the future wood supply of the eastern hemisphere, if not of the world. Whether her immense forest resources will be handled with the idea of continuous production or whether they will be wastefully exploited will be decided by the wisdom and foresight or lack of these qualities in her leaders of the immediate future.

REVIEWS

Forest Resources of the World. By Raphael Zon and William N. Sparhawk. McGraw-Hill, New York, N. Y.

This is a very creditable attempt to compile all the available information concerning the forest resources of the world and to interpret the economic significance of the same. The first 73 pages are devoted to this interpretation. They contain a summary of the situation based on a series of tables showing (1) forest areas in percentage of the area of forest based on total land area and the area per 100 inhabitants; (2) character of the forests showing acreage in conifers, hardwoods, and mixed conifers and hardwoods; (3) public and private ownership of the forests; (4) the annual production of wood; (5) the world's production of wood; (6) the world's trade in wood.

The authors draw the conclusion that of the 56 billion cubic feet of wood that the world uses, 30 billion cubic feet is fuel; that there are 4.4 acres of forest left for each person in the entire world, capable of producing 32.5 cubic feet per capita per annum; that the billion acres of Siberia, if fully developed, could export 6 billion cubic feet of timber a year; that tropical Africa, with more than 350 million acres of rain-forest, Asia and the East Indies with nearly 500 million acres and South America with one billion acres could, if fully developed and moderately well handled, produce continuously 200 to 250 billion cubic feet of wood a year, which is equal to four times the present world consumption.

This general summary is followed by a detailed discussion of the forest conditions of the different political units of the world, covering over 900 pages. The headings in this treatment are the forest area, character of the forests, character of ownership, annual growth, annual cut, domestic consumption, imports and exports, wood industries, forest laws and education, and probable future. The work closes with a brief discussion of the principal minor forest products. Accompanying the publication are finely executed maps in colors, one of the world and others of the different continents or parts thereof showing the different classes of forests.

Everyone who publishes compilations of this sort invites criticism, and it is only by the help of such criticism that progress is secured.

Perhaps no one realizes the lack of authentic data that goes to make up this report more than the authors, and with such a lack it is surprising that they made the attempt. Forest statistics are in a chaotic condition and the reader of this book who understands this will make the necessary reservations as to their value. But the vast majority of the readers do not know this and will take the vast array of figures as facts, the more so because the authors state in the introduction the work has the backing of the Forest Service and the National Research Council. With such backing, it will take many years to correct the many errors made in often substituting estimates where statistics are lacking.

To critically review the mass of data given in this publication would be a difficult task even if space permitted. It is made more difficult because there is no direct reference given to sources of information or methods used to compute the figures where reliable data are lacking. To be sure the bibliography is supposed to be the source of this information; in many instances it is incomplete and in some instances the references given do not help the seeker after sources. This makes one doubt many of the conclusions which could be explained satisfactorily were the sources of information more readily available for the purpose of checking. The reviewer is thus limited to discussing some of the problems with which he has some knowledge, either personal or through the literature.

On page 703 appears this statement: "Figures on annual growth in an almost entirely undeveloped forest region such as Brazil would be practically meaningless." Yet on page 41 the annual growth is computed at 1,300,000 M cubic feet or 1.3 cubic feet per acre, and curiously enough the total annual cut and total annual growth exactly offset each other. Incidentally, this method of computing is used in many tropical countries.

On the other hand, Trinidad and Tobago (p. 40) have an annual growth of 26.4 cubic feet per acre, and an annual cut of 3.2 per acre, or an increment of 23.2 cubic feet per acre. It is presumed that this high increment is arrived at by the fact that large areas in Trinidad are second-growth forests. At least such is the case here as in other tropical regions including Brazil. Thus we find (pp. 692-693) that

the authors accept the Brazilian figures (although the fact of this acceptance is not stated) that there are 850 million acres of virgin forests (called by the authors "merchantable timber") to which they add 150 million acres of cut-over land, making a total forested area of one billion acres. Now this 150 million acres is growing extremely rapidly, say as a rough, very conservative guess, of 50 cubic feet a year. Making all due allowance for non-usable woods, decay, etc., we have an annual increment of 7,500,000 M cubic feet, which, scattered over the one billion acres, would give a per acre production of 7.5 cubic feet, instead of 1.3.

The failure to recognize clearly the fact that large areas of second growth forests occur in most tropical countries and that annual per acre increment on these areas is great has led to an underestimate of the annual growth in such countries. This is probably due to the lack of data on the subject, for in some few countries like Salvador, the annual growth is stated to be 28.9 cubic feet per acre, whereas in Costa Rica, it is only 1 cubic foot per acre. While Costa Rica has not proportionally as large areas of second forests as Salvador, yet one cannot believe there is such a wide divergence in the annual growth between the two countries.

The figures on annual growth quoted for the Philippines (p. 472) apply to an estimate made of growth within the virgin forests where it is offset by decay, and therefore do not apply.

Incidentally, one wonders why the authors have not included a list of the principal woods of the Philippines where there is a wealth of information concerning their character and uses with correct botanical identifications, while on the other hand, a list of woods for many other tropical countries with perfectly meaningless descriptions is given, and often incorrect scientific names are attached.

Take Guatemala for instance. The mahogany of Guatemala and incidentally of Mexico and other Central American countries is not as the authors state "Swietenia mahagoni," nor is the Spanish cedar "Cedrela odorata." We find on page 572 that Mario (should be Maria or Santa Maria) "has hard wood, which twists badly, and therefore little used." As a matter of fact, it does not twist badly when properly handled, and is used much more than many of the other woods mentioned, and is sometimes mixed with mahogany shipments. It is the same wood referred to as occurring in British Honduras mentioned on

page 563 and called Santa Maria, Calophyllum calaba, in Panama (p. 586), in Mexico (p. 612), also in Trinidad (p. 630).

Again we find, on page 572, that Cortez (no scientific name given) "resembles ebony." Only by the greatest stretch of the imagination could this wood be said to resemble ebony. A search of the literature would have revealed to the authors that this wood is a species of Tecoma and is the equivalent of a number of other species of the same genus occurring in all tropical American countries from Mexico to northern Argentina.

These are only a few of hundreds of other instances of mistakes or irrelevant remarks that the authors have fallen into by accepting statements made by incompetent observers. Does the reader gain any real information from the following statements made on page 572? "Piche is a valuable wood found in Peten district," or "Palo blanco is very resistant to fire," or "Ron-ron contains tannin."

Harping back to Brazil, we find that about three-fifths of the area of the State of Sao Paulo (see map of South America opposite p. 666) is covered with Parana pine. The cattlemen and some of the coffee growers of this region will be surprised to learn that they have been cutting Parana pine to clear ground for raising grass or to grow coffee. As a matter of fact, there is very little Parana pine in Sao Paulo. Concerning this, the following statement is made (p. 700): "Covering a gross area of 300,000 square miles, the area of commercially valuable pine forest (mostly between 22° and 27° latitude) is estimated at about 100 million acres." It would be nearer the truth to state the following: "Covering a gross area of 100,000 square miles, the area of commercially valuable pine timber (mostly between 23° and 29°) is estimated at about 35 million acres."

Again on page 701, we find that "the total stand of Parana pine has been estimated at all the way from 200 to 650 million board feet." The reviewer wonders if the figure—650 million board feet—is not a misquoted one from an estimate made of all the timber in Brazil from and including Bahia south to the Uruguay line!

On the whole, with the exceptions noted, the write-up of the character of the forests in Brazil is as good as any that has been done in English. To be sure, it is a little confusing in places, and in this respect it is like the original article in Portuguese which appears to be the source of much of the material. In one place the authors have

dded a little to the confusion for, in speaking of the forests of the Atlantic coast, they state that it "varies in width from 30 or 40 miles at the north end to 200 miles in Espirito Santo." Brazilians and some others will be surprised to learn that Espirito Santo is 200 miles wide.

On the whole, Africa is well done. No doubt this is due to the fact that because of European interests with organized forest departments there, Africa is better known than Latin America. The same holds true for most temperate regions with the possible exception of Siberia where there seems to be as much confusion about the forests as there is about political conditions in Russia. At any rate, recent data seen by the writer indicate either that the authors have greatly exaggerated the possibilities of Siberia to produce wood under forest management, or that this recent data is not as reliable as theirs.

H. N. WHITFORD.

American Lumber Industry. By Nelson Courtland Brown. John Wiley & Sons, New York.

The lumber industry has recently received a large share of attention from the forestry writers. Other books have dealt with different phases of the industry such as logging, sawmills, lumber and forest products, and now this last book of Mr. Brown's deals with the industry as a whole.

The book contains a tremendous amount of detailed information. In it are concentrated statistics from many sources. It will be a wonderfully convenient reference for those interested in the lumber industry.

Anyone wishing to criticize might say that the author was inconsistent in his treatment of the subject. Some parts of the operation—probably because they are covered by other books—are so sketchily described that it is a question whether it would not have been better to leave them out altogether. While other parts, and not always such very important parts, are described in such detail as is scarcely warranted outside of a manual.

For instance, the history of the lumber industry, without which no one can really understand the industry as it exists today, is summarily disposed of in four short pages, and the preservative treatment of wood, never of great import to the lumber business, is given seven pages.

It may be good forestry policy to educate the people in regard to the importance of the forest as a recreation ground, a game preserve, a

water reservoir, etc., but their influence on the lumber industry is doubtful and certainly they do not deserve more space than the price of stumpage.

A two and one-half page description of the logging methods of the United States would better be left out, for it can not be of any real value. Nor can the student expect much light from the four-page description of the sawmill operations. While the seasoning of lumber covers twice the space of these two major operations put together. And yet this description of seasoning, though too long to fit in with the other parts of the book, is altogether too short for complete and usable information.

On the whole, it is a good superficial description of the industry with a great deal of valuable information in regard to it. But there is a regrettable lack of connection between cause and effect, demand and supply, influences and products sold, capital invested and prices obtained, and such like that the wide experience of the author might have led us to expect.

It gives a good impression of the shell of the animal but makes one feel vaguely that somehow he has not got in where the animal lives.

E. G. C.

Tree Ancestors. By Edward Wilber Berry, Professor of Paleontology, Johns Hopkins University. Williams and Wilkins, Baltimore, Md., 1923. Pp. 269, figs. 48.

Professor Berry, in an attractive volume, outlines the changes in the geological distribution of trees which have occurred with the development of geological history. The contents of the book is limited to the thirty-six genera of North American trees whose geological history is best known or which have particular interest for other reasons. Mention of some of the most important and also the most ancient groups, such as the pines, spruces and their allies, has been omitted because the evidence is incomplete or conflicting.

Introductory chapters outline the geological principles, the methods of preservation of fossil plants, the methods of reckoning geological time, the later geological history of North America, and the present distribution of the forests of North America. Following that, a chapter is devoted to each genus or group of closely related genera and gives a brief account of the origin and history of the name, the principal species

and their world distribution, a description of their characteristics, the uses and value of the wood or other products, the geological origin, and the abundance and distribution of the genus in each major geological period.

The sequoia has the most ancient lineage of any of the groups mentioned in the book. Its remains have been found in the late Jurassic period which was characterized by widespread warm seas and the preponderance of reptiles, cycads and tree ferns and coniferous forests. Several species of gingko were abundant. The dicotyledonous plants originated in this period. The only mammals were a few mouse-like forms. The Andes, Alps, Himalayas, and Rocky Mountains were not yet elevated. Geological time can not be reckoned exactly, but the sequoia must have flourished not much less than 10 million years ago.

In the succeeding cretaceous period many groups of forests trees and forest flora developed. Palms were common and various animals also originated in this period. A shallow, warm, inland sea extended from the Gulf of Mexico across what are now the Rocky Mountains and Great Plains, to the Arctic. The sassafras, poplars, walnuts, yellow poplar, oaks, maples, magnolia, beech, tupelo gum, willows, elms, and birches all originated in the latter part of this period. Conditions were such that trees which now grow only in warm, temperate climates were abundant far to the northward. On the west coast of Greenland fossil remains have been found of walnuts, magnolias and poplars. The camphor tree, palms and figs grew in Canada, and in the Rocky Mountains figs, fan palms, araucaria, and no less than ten species each of magnolia and yellow poplar flourished. Sassafras in that far-off time had leaf forms which can hardly be distinguished from those of the present day. The earliest fossil forms of beech are found in the upper Cretaceous period in Saxony and in Dakota. At present there are four species, one in the eastern United States, one in Europe, and two in eastern Asia. Such a distribution can only point to an origin either in the Arctic or in Asia. However, the beech has not been found in the Greenland beds of this period and hence it is concluded that it originated in Asia. This is only one example of the frequent, interesting illustrations of the light which their geological history throws on the present distribution of some of our common trees.

During the succeeding period known as the Eocene, the forests in the polar regions were all united. There was a free interchange of animal and vegetable life between Europe, North America, and Asia.

Figs and palms, cypresses and gingkos flourished in western North America, and tropical trees such as the breadfruit grew in the southeastern United States. In addition to the kinds of trees which originated in the Cretaceous, the first remains are found in the Eocene of the cypress, chestnut, hickory, and basswood. There were many species of poplar, sycamore, magnolia, and maple. Basswood offers the best example of the different climatic conditions and floral distribution of geological times. Fossil remains of this genus have been found in Montana, Sachalin Island, Iceland, Spitzbergen, Greenland, and Alaska. Evidently it had its origin in the Far North. Cypresses (axodium) were also found in Alaska, Alberta, British Columbia, Siberia, Manchuria, Greenland, and Spitzbergen and thence to Montana, Wyoming, Nevada, and over Asia to Europe.

Comparatively few fossil records of oligocene trees have been found, especially in this country. The period saw the maximum warmth of climate over the world and the elevation of the Cordilleran Mountain system. The first records of the black and honey locusts belong in this period.

The Miocene, in which period the Alps were elevated, saw the zenith of forest development. It was preeminently a period of hardwood forests and almost all the genera mentioned in the book were represented by many species widely distributed. The beds of Lake Florissant in Colorado of this period have furnished fossils of figs, magnolias, beech, elm, maple, locust, oak, alianthus, incense cedar, and sequoia.

All of these forest types continued to be represented over a large part of the world during the succeeding Pliocene period when the Andes Mountains were elevated.

The Pleistocene is the most recent geological period and is characterized by the series of advances and retreats of the continental glaciers. Up to this time cypresses, yellow poplar, red gum, hickory, walnut, magnolia, locust, and many others were common in Europe. The glaciers from the North gradually forced them southward and the mountains and seas from the Pyrenees to the Caucasus prevented their escape to the southward, so that these forms were exterminated and are not found naturally in Europe today. In North America, not only have the many species which once flourished in the polar region been forced southward, but during the periods when the glaciers advanced farthest south some of the tree species also occurred south of their present ranges. Remains of tamarack have been found in Georgia and

of spruce and Douglas fir in Kansas. On the other hand, during an interglacial period figs occurred in British Columbia and the osage orange near Toronto.

Two interesting principles are brought out by Professor Berry in regard to distribution of forest trees. One is that when closely related forms are today few and widely separated, as in the case of magnolia, yellow poplar, cypress, and sassafras, their ancestors occupied the intervening territory in geological times and a long and interesting geological history is indicated even in the absence of fossil forms. Second, he concludes that the present geological distribution of plants is almost entirely the end product of their distribution in ancient geological ages.

A few minor inaccuracies in names occur, chiefly in connection with the discussion of the distribution of the present forests of the western United States, such as "red fir (*Pseudotsuga nobilis* and *magnifica*) is the prevailing tree in the vicinity of Puget Sound and southward in Washington and Oregon," and "the eastern slopes of the Sierra Nevadas are characterized by a *variety* of large and valuable pines." The white birch (*Betula populifolia?*) is mentioned as occurring "in the far north or on mountains." In one or two cases the text mentions figures or maps which for some reason have not been included in the book.

On the whole, Professor Berry presents a fascinating account of past tree distribution in its relation to present distribution. To the reviewer, and probably to many foresters, it comes as a surprise that there is so much fossil material and that so much is known of the origin and geological past of our common trees. The book is written in simple, nontechnical language and will be found interesting as well as illuminating to anyone and everyone who is interested in the forests. J. K.

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NOTES

Redwoods League Saves Several Groves

Two splendid tracts of redwood timber were saved and funds established for the purchase of three more during the year 1923, according to the annual report of the Save the Redwoods League, recently issued. The Humboldt Pioneer Memorial Grove, 9 miles north of Orick on the State Highway in Humboldt County, was given to the State of California through the Save the Redwoods League, and the supervisors of San Mateo County appropriated $70,000 to purchase as a county park the McCormick tract of 310 acres on the county highway 6 miles from Pescadero.

Both of these are beautiful stands of timber. The Humboldt Pioneer Grove, the gift of Mrs. Zipporah Russ, of Ferndale, is extremely important because it constitutes the beginning of a second unit of the Humboldt State Redwood Park along the highway north of Eureka and leading to Crescent City. It is one of the heaviest stands of timber anywhere in the Redwood Belt. It is conservatively valued at over $100,000. In deeding this tract Mrs. Russ asked that it be made a memorial to her husband, Joseph Russ, and to all the pioneers of Humboldt County.

Through E. E. Ayer of Chicago a fund of $20,000 has been made available to the League for the purchase of a redwood grove and through a donor who wishes his name withheld, a resident of Massachusetts, another fund of $25,000 has been established. At Eureka on May 4 the California State Federation of Women's Clubs unanimously voted to establish a fund for the purchase of a memorial grove at a price of approximately $60,000. This fund is now being collected and a substantial amount is already in hand.

From a part of the fund raised by Mr. Ayer the League has already been able to aid the State through the purchase and deeding to the people of California of 6½ acres of land adjoining the Phillipsville Grove, thus affording adequate public camping facilities at this grove.

The report shows that including the California State Redwood Park in the Big Basin, which includes 2,500 acres, there are 6,157 acres of redwoods that have been preserved out of 1,000,000 acres of standing

redwood timber in the State. The new Humboldt County Redwood Park contains 2,425 acres and there are various scattered groves through the redwood belt that have been made public parks.

The report deals with the passage of the Rosenshine Act which provides for a State-wide survey of the redwood belt with the view to outlining a system for State parks. It tells of various other accomplishments of the League and lists a number of gifts during the past year, notable among them being gifts from E. E. Ayer, Edward Doheny, Wm. G. Mather, Samuel Mather, Julius Rosenwald, Martin A. Ryerson, Wm. L. Brown, Frank Miller, Edward Butler, Dr. Norman Bridge, Richard Crane, Stephen T. Mather, Mrs. E. H. Harriman, and Mrs. William H. Crocker.

Forestry in Manchuria

The following notes relating to forestry in Manchuria were taken from "Manchuria—Land of Opportunities." South Manchuria Railway. 1922:

Distribution of Forests.—In South Manchuria, the foot of the Changpai Mountains, along the upper reaches of the Sungari, the Mutan and the Tumen, and also the upper parts of the Yalu and the Hun are densely wooded; while in North Manchuria, the districts about Hailin on the Eastern Section (between Harbin and Pogranichnaya) of the Chinese Eastern Railway and about Sansing in Kirin Province are the principal forest lands. Mongolia is a vast plain consisting of level land grown with grass and dotted with dunes. Nothing like a forest can be seen.

The forest areas are estimated as follows:

(a) On the right bank of the Yalu and along the Hun River; 1,600,000 acres with 6,900,000,000 cubic feet of timber.

(b) On the upper parts of the Sungari, the Mutan and the Tumen; 4,800,000 acres with 26,000,000,000 cubic feet of timber.

(c) Along the Eastern Section (between Harbin and Pogranichnaya); 6,000,000 acres with 18,500,000,000 cubic feet of timber.

(d) About Sansing district; 13,000,000 acres with 52,000,000,000 cubic feet.

(e) As to the forests in and about the Hingan Range, no data can be obtained, except that in the districts within a radius of about 30 miles around Horgo and Hingan Stations, the average timber asset is put at about 1,300 cubic feet to the acre.

Forest Conservation.—Manchuria needs afforesting in many places. Hills and mountains now bare and barren but capable of being converted into fine forests for the benefit of the people, both from an economic and hygienic point of view, are visible everywhere. This is especially true in Kwantung, which is mountainous, yet with few trees on the mountains. The only trees seen in that region, when the administration of it was handed over to Japan, were a few willows and elms near villages and tombs. Nursery gardens were established at Port Arthur, Chinchow, and Dairen, to supply saplings for afforestation undertaken by the government. Several million young trees have been planted annually for the past few years.

The Fushun Colliery has instituted a very extensive program of afforestation to provide timber for the mines. It is estimated that 54,000 acres must be planted with 110,000,000 trees, and the program calls for the completion of this plan in a period of thirty years. In the first year, 1919, an area of 980 acres was planted with 2,000,000 young trees, and at the same time 44,000,000 of sprouts were started in the nursery fields.

Also, to encourage the general public in this useful undertaking, forest lands are rented free of charge to those desiring to afforest them, and seeds and young plants are supplied to them. Regulations have also been published for the protection of forests. These measures have had the desired effect, and, with the increase in the interest taken by the public in the matter of afforestation, many nursery gardens owned by villages have been formed.

Varieties of Trees.—About 300 kinds of trees are known in Manchuria and Mongolia, but the principal varieties number about 20. About 40 per cent of the forests are conifers, and 60 per cent broad-leafed trees. Korean pines are the most common conifers. They are frequently from 4 to 5 feet in diameter, reaching a height of more than 100 feet. Oaks, elms, and poplars are the most common broad-leafed trees.

Timber Industry.—As timber markets, Kirin and Antung come foremost, followed by such consuming centers as Harbin, Changchun, Mukden, and Dairen. Kirin has long been a timber center. Along the eastern section of the Chinese Eastern Railway the railway management and Russians and Chinese have had railway sidings built to their lumber yards and are operating saw mills. Both Kirin and Yalu timber is carried down the rivers.

Development of Mining.—Mining in South Manchuria is of remote origin. Local tradition declares that the coal mine at Fushun was worked as early as the twelfth century, but its working was prohibited by the founder of the late Manchu Dynasty from a superstitious belief in *fengshui* (Spirit of Nature). There were evidently some other mines once worked. But, except for some conspicuous ones, traces of their working have been entirely effaced by the elements, particularly by the landslides caused by the indiscriminate felling of trees once universally perpetrated throughout the country. It seems that most old mines were discovered during the course of this general deforestation, but this same action doomed the fate of the mines thus discovered since it deprived them of the wood indispensable in mining. Even after the removal of the prohibitory law, every possible obstacle was laid wittingly or unwittingly in the way of mining exploitation.

Lumber.—Many sawmills are now in operation at Antung, at the mouth of the Yalu, and at Kirin on the Sungari River. The lumber industry on the Yalu River has been developed by the Yalu Lumber Company, a Chinese-Japanese organization established in 1908 with a capital of 3,000,000 yen. This same company also organized the Yalu Sawmill Company, with a capital of 500,000 yen. At Kirin are located the Mitsui Company's mill, the Kirin Timber Company, and a branch of the Yalu Sawmill Company.

Other Industries.— * * * The pulp closely resembles timber pulp and makes an excellent grade of paper. From the ash of *kaoliang* stalks potassium salts are obtained for use in the manufacture of glass, medicines, fertilizers and other products.

SOCIETY AFFAIRS

Report of the Treasurer for 1923

Receipts

Balance on hand January 1, 1923			$2,574.48
Annual dues:			
1921	$5.00		
1922	121.00		
1923	3,345.02		
1924	53.50		
		$3,524.52	
Subscriptions to Journal:			
1921, Vol. 19	$2.00		
1922, Vol. 20	92.00		
1923, Vol. 21	2,361.11		
1924, Vol. 22	224.54		
		2,679.65	
Sale of back numbers, etc.:			
Journals	$169.29		
Forestry Quarterlies	43.48		
Proceedings	9.76		
Lists of members	2.00		
		224.53	
Advertising:			
By commercial institutions	$58.00		
By educational institutions	180.00		
		238.00	
Society pins		33.65	
Miscellaneous:			
Refund for illustration used	$24.45		
Refund of postage by Mrs. Fernow	2.26		
Interest on bank deposit	51.27		
		77.98	
Special funds:			
Interest on bonds		42.40	
Total			$6,820.73
Grand total			$9,395.21

Disbursements

Publication and distribution of Journal:		
Printing Vol. 20, Nos. 7-8	$1,162.99	
Printing Vol. 21, Nos. 1 to 7	3,697.76	
Line cuts and half tones	73.70	
Pen drawing	5.00	
Preparing copy and proofreading	225.00	
Postage	125.79	
Stencils	15.92	
Envelopes for mailing	302.00	
		$5,608.16

Miscellaneous printing:		
Programs of meeting	$29.00	
Ballots and envelopes	15.00	
Nomination blanks	37.50	
Letterheads	11.50	
Proposed amendments	17.50	
Membership cards	10.75	
Lists of candidates	151.25	
Circular letters and post cards	24.40	
		296.90
Stationery and postage (exclusive of JOURNAL):		
Stamped envelopes	$83.96	
Stamps	59.85	
		143.81
Clerical and stenographic work		220.00
Addressing envelopes and folding		20.75
Telegrams		8.18
Express		16.01
Society pins		33.60
Miscellaneous:		
Refunds on dues and subscriptions	$18.00	
Wreath for Dr. Fernow's funeral	13.00	
Binding set of Quarterlies	35.00	
Back numbers purchased	9.35	
Expenses, Boston meeting	68.05	
New addressing machine	56.30	
New cabinet for stencils	13.03	
Ribbons for machine	1.55	
Rubber stamps	2.45	
Bank charge for exchange on check	.30	
		217.03
Special funds:		
Bond for investment		496.71
Total		$7,061.15
Balance on hand		2,334.06
Grand total		$9,395.21

ASSETS

Balance on hand		$2,334.06	
Annual dues:			
16 at $1.50 (elected in October)	$24.00		
31 at $5.00	155.00		
35 at $4.00	140.00		
		319.00	
Sales of back numbers		14.70	
Advertising		10.00	
Bonds for investments		1,000.00	
Total			$3,677.76

LIABILITIES.

Dues paid in advance	$53.50	
Subscriptions paid in advance	224.54	
Clerical and stenographic work	46.50	

Printing and mailing December JOURNAL	503.37	
Preparing copy and proofreading	25.00	
Stencils	6.19	
Total		$859.10
Excess of assets over liabilities		$2,818.66

SPECIAL FUNDS

One $500 bond	$500.00	
Five $100 notes	500.00	
		$1,000.00
Interest on above, 1923	$42.40	
Interest on above, 1922	7.98	
		50.38
Contribution, emergency fund		20.80
Contribution, permanent fund		15.00
Interest on above:		
February 1, 1922, to December 31, 1923		1.40
Total		$1,087.58

F. W. BESLEY, *Treasurer.*

Audited and found correct by A. H. PIERSON.

A SUGGESTION BY W. W. ASHE

Several excellent recommendations have recently been made respecting the JOURNAL OF FORESTRY; one, in particular, regarding the inclusion of a paragraph of personal notes, made by Willis M. Baker, seems particularly meritorious. It might possibly be well to go even somewhat farther.

During the past summer in conversing with members of forestry departments of a number of States I was deeply impressed by the lack of information concerning work which was being carried on by confreres in other States. In large measure this situation resulted from the fact that the department under which the work had been carried on had not yet published the findings. It was good work, and fitting to be noised from the house-tops; but the men engaged on it were still too busy working to seek places among the literati or radio their results for the benefit of others. Only one case of this kind would lack significance; but there were many. There is evidently much work being accomplished by public service workers as well as by private foresters the results of which are unpublished, but which, if known, would be most valuable to co-workers.

In order to make known the existence of such work and to keep workers better in touch with what others are accomplishing, would it

not be desirable, and possible also, to induce members of the Society once or twice a year to transmit to the editor of the JOURNAL a few lines relating to work on which engaged, results secured, or projects under way? These items, grouped together, could be printed in a separate portion of the JOURNAL in each issue. They would be of value in keeping workers in touch with the projects of others and might prevent much duplication of effort.

References such as these, and personal notes, are ephemeral and largely of transient interest. They would really constitute *news items* and might well be issued separately from the JOURNAL but distributed with it. They might well be grouped under the three great classes, practically three different professions, which constitute the membership of the Society—teachers, public service employees, and private and consulting foresters. To a certain extent each class has its own point of view and objectives. It would seem that the numbers in each class and its membership in the Society had now reached the point where it might be desirable to give separate consideration to news matters of particular interest to each respective class, such as personal notes, opportunities for positions and special projects, completed or under way.

CIRCULATION OF THE JOURNAL

The following figures showing the paid circulation of the JOURNAL for May, 1922, and May, 1923, may be of interest:

	1922	*1923*
Maine	40	45
New Hampshire	17	25
Vermont	10	8
Massachusetts	40	45
Rhode Island	3	4
Connecticut	24	23
New York	99	101
New Jersey	13	13
Pennsylvania	49	55
Delaware	0	0
Maryland	9	8
Dist. Columbia	65	70
Virginia	13	14
West Virginia	3	4
North Carolina	14	17
South Carolina	1	0
Georgia	1	1
Florida	6	8

	1922	*1923*
Alabama	4	5
Mississippi	1	3
Tennessee	6	5
Kentucky	1	1
Louisiana	7	7
Texas	5	5
Arkansas	5	4
Oklahoma	1	1
Ohio	15	16
Indiana	5	4
Illinois	12	9
Michigan	22	24
Wisconsin	31	35
Minnesota	26	28
Iowa	5	5
Missouri	6	6
Kansas	1	2
Nebraska	5	5
South Dakota	5	5
North Dakota	2	2

Montana	71	69
Idaho	48	43
Wyoming	13	13
Utah	26	25
Colorado	50	52
Nevada	5	4
New Mexico	29	33
Arizona	24	25
Washington	38	39
Oregon	60	64
California	87	100
Alaska	7	6
Hawaii	4	4
Porto Rico	1	1
Philippines	4	4
Canada	163	174
Newfoundland	1	2
Mexico	1	1
Colombia	1	0
Brazil	1	0
England	6	5
Holland	1	1
Wales	1	1
Ireland	1	2
Denmark	1	4
Norway	2	2
Sweden	4	5
Finland	1	1
Poland	0	1
China	3	5
Japan	28	30
India	11	11
Br. East Indies	4	3
Dutch E. Indies	4	4
Cyprus	1	0
Australia	5	7
New Zealand	12	12
Africa	14	22

Summary:

United States	1,023	1,080
Other North America	173	184
South America	2	0
Europe	17	22
Asia	55	57
Australia and Oceania	21	23
Africa	14	22
Total	1,305	1,388

Of the total for May, 1923, 768 are members of the Society, 620 are outside subscribers.

The Washington Section

The Washington Section of the Society of American Foresters has been holding an interesting series of meetings during the 1923 and 1924 season. The general theme of the meetings has been the practice of forestry by private individuals and companies in the various forest regions of the country. The general plan for the meetings was outlined at the first meeting by John F. Preston, who took the ground that private forestry was developing rapidly and that the general tendency of foresters was to be too pesemistic.

The first of the series was held on November 8 when D. T. Mason, consulting forester from Portland, Oreg., told of the rapid development of private forestry in the redwood region of California. Dr. E. P. Meinecke, forest pathologist, of San Francisco, who told of the progressive trends of the California Section and of the rather lively meetings that were held, was present, as was also W. R. B. Hine, from the Southern Forest Experiment Station, who told of the development of the growth study in the southern pine region, and the interest of the operators of the south in forestry.

On December 13, George H. Collingwood introduced the subject of farm forestry, describing the development of the forestry movement in the States. Present and leading the discussion were a number of State foresters and extension directors of nearby States.

On January 10, E. I. Kotok, of the Forest Service at San Francisco, described the rapid development of forestry in the pine region of California. The trend of most of the lumbermen was toward a more sympathetic attitude toward all forestry matters, and while the pine operators had not gone as far as had the redwood men, they were becoming more interested in the movement. Coert DuBois, formerly district forester of the California district, told of his work for the past five years in the consular work, chiefly in the eastern part of the Mediteranean region.

The meeting of the Section on February 7 was devoted to the forestry movement in the Northeast. The rapid growth of forestry there has been due in no small measure to the increasing scarcity of pulp wood and the strong local markets. The subject was introduced by L. S. Murphy, and the discussion was led by Messrs. Chandler, Martin, and Hastings. Coming at the close of the first meeting of the research advisory committee of the pulp and paper industry, much interest was aroused. Mr. Dana, of the Northeastern Forest Experiment Station, told of the rapid developments in the legislature of New York looking for State forest regulation.

Additional meetings to complete the program have been announced and will consider forestry in the Inland Empire, in the Pacific Northwest, and in the South.

The regular program of meetings has been supplemented by a dinner in honor of Major General Lord Loval and Dr. R. L. Robinson, who had been in attendance at the meeting of the British Empire Forestry Congress.

Southern Appalachian Section Meeting

The Southern Appalachian Section of the Society of American Foresters held its third annual meeting in the City Y. M. C. A., Asheville, N. C., February 2, 1924, with an attendance of between twenty-five and thirty. In the forenoon routine business was transacted, including the nomination of several men for membership in the Society. Andrew Gennett, President of the Appalachian Logging Congress, and Robert W. Griffith, Extract Sales Manager, Champion Fibre Co., were elected associate members of the Section. Among other matters the Executive Committee of the Section was instructed to take up with the Executive Council of the Society the desirability of amending the constitution in order to increase the membership qualifications and possibly the establishment of a junior or collegiate grade.

A very interesting report of the deliberations and work of the Forest Type Classification Committee was presented by its Chairman, E. H. Frothingham. After carefully considering a number of different proposals as to the basis upon which to identify and classify the forest types of the southern Appalachian region, the committee recommended that the forest type should be based upon the existing cover of trees of generally recognized commercial importance, of major size with reference to site, and of species which participate in the dominant stand. Other basic principles were formulated. After some discussion the report was adopted and the committee was authorized to proceed with its work on the above basis and to submit its final report to the membership and others interested if possible in advance of the next annual meeting.

The following officers were elected for 1924: Chairman, E. H. Frothingham; Vice-Chairman, W. J. Damtoft; Secretary, C. F. Korstian, Box 1518, Asheville, N. C.

During the afternoon the following papers were read:

1. "Chestnut Wood in the Tanning Industry," by Robert W. Griffith, Sales Manager, Extract Department, Champion Fibre Company, Canton, N. C.

2. "Progress of the Chestnut Blight in the Southern Appalachian Forests," by G. F. Gravatt, Pathologist, U. S. Bureau of Plant Industry, Washington, D. C.

3. "The Position of Chestnut in the Timber Sale Policy of the Pisgah National Forest," by M. A. Mattoon, Forest Examiner, U. S. Forest Service, Asheville, N. C.

4. "Some Silvicultural Aspects of the Chestnut Blight Situation," by E. H. Frothingham, Director, Appalachian Forest Experiment Station, Asheville, N. C.

Mr. Gravatt's paper, which was read and discussed by Dr. Haven Metcalf will be found on page 193 of this issue of the JOURNAL. The other papers will doubtless appear in a forthcoming issue. Dr. F. C. Craighead, in charge of forest insect investigations in the U. S. Bureau of Entomology, discussed the relation of insects to the chestnut blight. After considerable informal discussion of this vitally important subject the following resolutions were unanimously adopted:

Whereas, The Southern Appalachian Section of the Society of American Foresters, is now assembled in its annual winter session, and,

Whereas, The discussion of the chestnut blight situation has shown the great economic value of chestnut to the tanning industry, that the total destruction of the chestnut is impending and inevitable, leading to widespread changes in forest composition, be it resolved that it is the sense of this meeting that immediate investigations are needed to determine the effect of the loss of the chestnut on the composition of the forest, and to determine what measures may be taken to delay the disease, and preserve the supply of chestnut wood as long as possible.

Whereas, The McNary bill (Senate Roll 1182) is now under consideration by Congress, be it resolved that we endorse this bill, and believe its enactment into law will be a distinct advance toward a satisfactory forest policy for this region.

Since this bill recognizes the need for forest research without definite provision of funds, we urge the need for further specific appropriation for forest research, especially with reference to chestnut blight.

Whereas, This bill provides for the extension of national aid in fire protection, and the states must expend an equal sum to benefit by this provision, we urge the states of the Southern Appalachian Region to fully utilize this assistance by greater appropriations for forest fire protective organizations.

NORTHERN ROCKY MOUNTAIN SECTION

At the annual business meeting of the Northern Rocky Mountain Section held at Missoula, December 10, 1923, the following officers were elected: Chairman, H. R. Flint; Secretary, W. W. White; Member of Executive Committee, Fred Morrell; Membership Committee:

L. C. Stockdale, *Chairman;* F. G. Clark, J. H. Ramskill, R. N. Cunningham, J. A. Larsen.

PROGRAM OF MEETINGS—WINTER 1923-24

December 10, 1923
Annual business meeting and election of officers.
January 7, 1924
"Progress in Forest Research," H. T. Gisborne.
January 21, 1924
"Forest School Curricula—Their Growth and Trend."
The Forest School Viewpoint, T. C. Spaulding.
The Forest Service Viewpoint, S. V. Fullaway.
"Study Courses in the Forest Service."
For the Forest Service, L. C. Stockdale.
For the Forest School, F. G. Clark.
February 4, 1924
"The Influence of Forest Enemies on Forest Succession," H. R. Flint.
February 18, 1924
"Impressions of European Forestry," J. A. Larsen
March 3, 1924
"Opportunities for the Practice of Intensive Forestry in Eastern Montana Forests," W. W. White.
March 17, 1924
"Range Management Problems," Glen A. Smith.
March 31, 1924
"A National Program of Forestry Applicable to the Northwest," Fred Morrell.
April 14, 1924
"The Importance of Land Economics as a Part of the National Forestry Program," H. G. Ade.
Date to be selected later
"Development of Permanent Transportation Systems in Relation to National Forest Management," Philip Neff
Topic to be selected later, L. G. Hornby.
Topic to be selected later, Elers Koch.

ASSOCIATE MEMBERSHIP

Mr. A. H. O. Rolle, Bureau of the Census, Washington, D. C., was elected to associate membership as of February 5, 1924.

MADISON SECTION

The Madison Section has elected Dr. E. E. Hubert President and George C. Morbeck Secretary-Treasurer for the present year.

New England Section

The New England Section gathered about 60 members at its annual meeting held in Boston, February 20. S. T. Dana was reelected Chairman and H. O. Cook Secretary. Five new men were nominated for membership, and four members were nominated for senior membership.

Meeting of the Ohio Valley Section

The first annual meeting of Ohio Valley Section, Society of American Foresters, was held at Wooster, Ohio, November 2 and 3, 1923. Edmund Secrest, State Forester of Ohio, Chairman; Russell Watson, University of Michigan, Secretary.

Meeting called to order 7 p. m., November 2, American Hotel, by Chairman Secrest.

Following members were present: P. S. Lovejoy, Ann Arbor; L. J. Young, Ann Arbor; Robert Craig, Jr., Ann Arbor; P. A. Herbert, East Lansing; B. N. Prentice, Purdue; B. E. Leete, Wooster, Ohio; F. W. Dean, Wooster, Ohio. In addition, State Forester Deam and Assistant State Forester Phillips of Indiana were present.

A letter from Richard Lieber, Director of Conservation, Indiana, was read, requesting that next meeting be held in Indiana.

The following officers were elected for 1923-1924: Chairman, Burt N. Prentice, Professor of Forestry, Purdue; Secretary, Russell Watson, Professor of Forestry, Ann Arbor; Director, P. S. Lovejoy, Ann Arbor.

It was decided to hold meeting following year in Indiana, at such place and time as directors decided.

The by-laws as drawn up at informal meeting January 20, 1923, were adopted, after changing Section 11 to read as follows: "Meetings of this Section shall be held *once* yearly or more often as the executive committee shall decide."

The following resolution was offered by Mr. Lovejoy, and adopted:

"1. It is the sense of this meeting that it is urgent that adequate areas of wild forest and swamp land be set aside as breeding grounds and for the protection of wild life.

"2. Copies of this resolution to be sent to appropriate organizations."

The chairman suggested that it would be desirable to have the Section go on record as favoring an Ohio Valley Experiment Station, of the U. S. Forest Service, and to this end Mr. Lovejoy proposed, and it

was adopted, that the present chairman appoint a committee to urge upon Congress and other interested bodies the need of an Ohio Valley Forest Experiment Station.

Mr. Secrest appointed the following members of the committee: A. K. Chittenden, Professor of Forestry, East Lansing, Mich.; C. C. Deam, State Forester of Indiana, Bluffton, Ind.; Robert Miller, State Forester of Illinois, Urbana, Ill.; Edmund Secrest, State Forester of Ohio, Chairman.

Authorization was given, and the Secretary was directed, to prepare abstracts of papers read at open meetings and distribute same to members, the costs to be assessed against members.

Meeting adjourned, to reassemble November 3, 9.30 a. m., at Assembly Hall, Administration Building, Ohio Experiment Station, Wooster.

Open Meeting November 3.

Called to order by Mr. Secrest. Forty-two were present.

Meeting was opened by short address of welcome from C. G. Williams, Director of Ohio Agricultural Experiment Station.

Mr. Secrest, as chairman, addressed the meeting. (See abstract of address.) (Complete address on file in office of secretary.)

Professor Paul A. Herbert, Michigan Agricultural Experiment Station, next gave an interesting address on forest fire insurance. Mr. Herbert outlined a plan of forest fire insurance, giving detailed figures as illustrations. (See the conclusions of his paper; his complete paper is on file in the office of the secretary.)

D. Lange, President of Minnesota Forestry Association, next spoke on forestry of river bottoms of Minnesota, giving a very interesting discussion of forest types and forest conditions, including a story of farm conditions on the overflow areas, and declared that forestry here had an opportunity to put to use some excellent forest lands that now were poorly used. The total area was estimated at some 160 square miles.

Dr. G. W. Conrey, Department of Soils, Ohio Experiment Station, gave an interesting and instructive talk, entitled Soil Variation and its Relation to Vegetation.

O. A. Alderman, Department of Forestry, Ohio Agricultural Experiment Station, gave a paper entitled Tulip-poplar, being a discussion of the silvics of the species in Ohio. It was "to gather definite data

regarding the production of poplar on some of the idle land of the State that the study of this species was undertaken." Tulip-poplar is not only a tree of best sites, but also "it is capable of growing on all the land of southeastern Ohio." The remarkable adaptability of tulip-poplar to soil or site conditions was shown repeatedly. Mixtures of poplar and pine were found, where the poplar made as much growth as the pine in an equal number of years, and one plot was found where poplar had outgrown pitch pine and shortleaf pine (this would be on poor sites). On best sites poplar was found 90 feet tall at 30 years; on poor sites, with pine, 30-year trees were only 30 feet tall.

Copy of this paper is on file with secretary.

With the completion of Mr. Alderman's paper, the meeting adjourned until 1.30 p. m., in same room.

Professor Osburne, Department of Zoology, Ohio State University, gave an interesting discussion on fish problems in relation to forestry. The point was made that dirty water, and great differences in amount of water, in creeks and rivers, vitally affect the life of fish, and, in fact, is the cause of many of the more valuable and game forms being lost. These effects many times were directly brought about by the destruction of forests and ill-advised drainage measures.

The chair last called upon C. C. Deam, State Forester of Indiana, an abstract of whose talk appears herewith.

Robert Miller, State Forester of Illinois, could not be present, but a short review of forestry in his State, written by himself, is appended.

This concluded the talks of the afternoon. The members then were taken on a tour of the plantations of many species of trees on the grounds of the Station.

At 6.30 a banquet was held at Wooster at which about 40 were present.

Mr. Staley, Deputy Commissioner of Forests and Waters, Pennsylvania, gave an illustrated talk on the forests of Pennsylvania.

Mr. Houser, Entomologist of Ohio Experiment Station, gave an illustrated lecture on airplanes as aid in spreading poison for tree-eating insects. The distribution of the poison dust from the airplane on to the leaves of the trees was well pictured and the methods employed were readily understood by the audience.

George Banzhaf, Forester for Marquette University, Milwaukee, spoke briefly on the work that the University is doing with its large land holdings in the Upper Peninsula of Michigan. The work at pres-

ent is mainly of examination and collection of data for preparation of working plans and policies.

Meeting adjourned at 9 p. m.

A Plan of Combined State and Federal Forest Insurance

By Paul A. Herbert,
Michigan Agricultural College

Better fire protection can reduce, but never eliminate, the risk to which capital invested in tree production is subject. Forest insurance will remove this risk and thus make forestry an attractive investment to the individual.

THE PLAN

1. All forest growth (optional with the farm woodlot) within the State shall be insured at a rate commensurable with the hazard to which it is exposed, and which shall be sufficient to cover the fire losses thereon and its proportionate part of the administration costs.

2. All such forest growth shall be valued either at market value or expectation value, at the option of the owner, subject to the approval of the State forester.

3. The determination of hazard, of loss, and of value shall be based upon the finding of forest actuaries.

4. The organization for the administration of this plan shall be as follows: (*a*) The State forester shall be responsible for its administration; (*b*) the forest actuaries, while responsible to the State forester and employed by him, must meet the standards set by the federal government; (*c*) the tax collecting authorities shall collect the premiums as determined upon by the forest actuary; (*d*) premiums shall be deposited with the state treasurer subject to withdrawal by order of the forester.

5. The Federal Government shall be empowered to reinsure all risks written by the several States provided the State conduct of this project meets the standard set by the Secretary of Agriculture.

6. Such reinsurance shall be written at approximately the average fire loss for each State.

This plan is theoretically sound and will supply protection much cheaper than is possible under any other plan. There are practical objections to its immediate application in many States, none of which, however, call for fundamental changes in the plan. The adoption of such a scheme of forest insurance as herein outlined will do more for constructive forestry in this country than any other conceivable program.

Forestry In Indiana

By Chas. C. Deam
State Forester

Our goal is to have every acre of untillable and non-grazing land in the most productive kind of trees; every hill slope that is too steep to be farmed without

washing to be in forest; and for every farm of 80 acres or more to have from 8 to 10 per cent of their area in forest. We do not accept the premise "Only non-agricultural land for forest."

The Division of Forestry maintains a central office at Indianapolis. The personnel consists of the State Forester and Assistant State Forester, and stenographer. Office facilities are greatly curtailed for lack of office room and money. However, permanent records are being made and a large library is being collected with hopes of expansion in the near future.

The State forest near Henryville now contains 2,898 acres. This forest is used to study silvicultural problems in the broadest sense. Only about 300 acres of the area was ever cleared. The native second growth is being studied to ascertain the best management of second growth and burned over second growth. About 175 acres of the cleared area has been planted with about 30 different species to ascertain the relative tolerance of the several species to site. Rate of growth of the several plots is obtained and a program of calipering each tract at the end of each ten-year period has been adopted.

A nursery has been started which is planned to furnish land owners seedlings at cost of production. The stock on hand at present consists of 131,000 one-year-old hardwood seedlings, 173,800 one-year-old conifers, and 49,500 two-year-old conifers.

Field work consists in the inspection of woodland for the purpose of having it classified as forest land under the Indiana tax law. During two years 90 owners have classified about 5,000 acres. The average value of the land (exclusive of the forest crop on it) classified per acre is $40.55. It is estimated that Indiana has about 6 per cent of her area in forest and I estimate that not more than 1 per cent of this area could be classified without additional planting. It is believed we now have several hundred thousands of acres of abandoned farm land which must ultimately be reforested.

Progress In Illinois

By Robert Miller

State Forester

1. *What has been done?* Under the heading we may say that we have completed the field work for a forestry survey of the State and we are entering this upon maps similar to those which you saw when you were in our office. Totals for various classes of land have not yet been compiled but we are placing a tentative estimate on the total of woodlands of the State at 2,500,000 acres. Of this amount 326,000 acres is outside of farm woodlands, leaving about 2,150,000 as the acreage of farm woodlands, which falls somewhat below the estimate by the Bureau of Census for 1920 (3,120,000).

2. *What is being done?* In addition to finishing up the mapping for this survey we are carrying on work on the economic survey the purpose of which is briefly to furnish an economic background for forestry in this State. The material collected by the farm woodland questionnaire will form part of this report.

3. *What we plan to do.* (*a*) According to Dr. Forbes' plan make a survey of deforested lands in the State, but someone else can probably decide better on this

than foresters. (*b*) Carry on and continue growth studies on certain types of soil not now needed for agriculture. Some field work has already been done on bottom species and upland species will be taken up next spring. (*c*) By July, 1925, we hope to have secured either under the University or as a separate appropriation a sum which will enable us to start extension work in forestry under the experiment station through cooperation perhaps between the natural history survey and the experiment station at the university. The object of this is to put to good use the information which we have collected, and get this out to farmers through the county agents.

So far as I know this about covers our plans and detailed information will be found in the economic bulletin which we hope will be published some time this winter.

Summary of Address of Retiring Chairman

Edmund Secrest,
State Forester of Ohio

The sections of the Society give an opportunity for discussion by men interested in problems of similar nature. The Ohio Valley Section is particularly interested in forestry in the central hardwood region. Here members may express themselves fearlessly, and obtain good criticisms from sympathetic men.

The region covered by this section is the very heart of the greatest specialized industry in the world, and the center of timber consumption. Shifting of production to the far West means better prices for local timber. Increased local stumpage prices are apparent; stumpage prices are about double from 1913 price average. White ash in 1912 brought from $18 to $40 stumpage; this fall once it brought $55. Prices have decreased little if any from war peak prices.

As a consequence of high prices, much farm land is valuable for forestry that 15 years ago was considered too good. Furthermore, 702,000 acres of improved land went into *unimproved* condition since 1900 in Ohio. Old fields of South Ohio are going back to characteristic Appalachian growth—namely, sassafras, sumac, and locust, followed by tulip poplar and oaks.

Forest land can, of course, be devoted to farm land if desired. Farmers want to know: "How can I make this a better woods, what can I plant in the open places?" and not "Is this forest land?"

The farm woods is the single important factor in timber production in the region, and around it our efforts must be centered. Can not rely upon public forests, but must work for advancement of private forestry. In Ohio, 90 per cent of woods are farm woods, 10 per cent owned by mining companies and timber operators and land speculators. Amount of farm woods cleared probably will be more than offset by reversion of low grade farm lands to forests. Have 5,000,000 acres either in forest or suitable, and this will supply State. Public forest must blaze the way for private efforts. Hence State forests should be distributed over State evenly as object lessons.

To induce farmers to practice forestry is a big job. Practice of grazing has made Ohio's woods produce less than 40 board feet per acre per year. Economic loss is huge. Pastured woods is poor pasture, and woodland pasture is not a forest.

Our general forest programs will materialize most quickly if efforts are spent in a well organized system of personal service.

Future wood requirements must be provided for in advance. It is time to get busy, lay solid foundations.

Abstract of Dr. G. W. Conrey's Paper on Soil Variation and Its Relation to Native Vegetation

The factors controlling the distribution of vegetation are usually classified into climatic and edaphic. Of the edaphic factors, those related to the soil are slope and moisture supply. Soil characteristics developed under any given conditions result from the combined effect of climate, slope and moisture supply, hence variation in native vegetation can often be correlated with soil variation.

Soils differ in texture, or the size of the constituent mineral particles, in lime content, and in color. The first two are closely associated with the character of the parent material. The third—color—is dependent on the conditions under which the soil has existed, and is closely related to topography and drainage. Probably the ultimate product in soil development is the soil of intermediate slope and drainage. It is interesting to note that this is the topographic position of the climax forest.

In a level to gently rolling region like the glacial plain the nature of the soils is largely determined by topography and drainage, along with the character of the parent material, and a close relationship should exist between sois and natural vegetation. In a highly dissected region slope and exposure are very largely the determinative factors, the results of which are more or less modified by the nature of the material from which the soil is derived.

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